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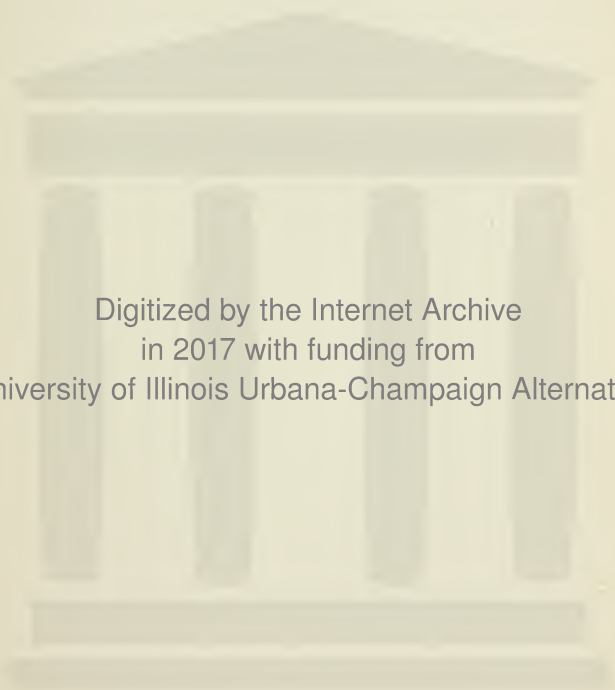
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TO MY FATHER.

HYDROPHOBIA,

BY

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PREFACE.

It has been my endeavor to embody in compact form the literature pertaining to the subject of hydrophobia. The necessity of such a work has been long recognized in the Profession, and the growing interest among the laity leads me to believe that they will receive such a publication kindly. The bibliography of the subject is so extensive, covering so large a field of diverse languages, that few practitioners have the facilities of traversing it. In American literature there never has been published an exhaustive treatise upon the disease, scattering reports in medical journals, and occasional monographs, being the sum of all that has been written in the United States. To condense into convenient size the History of the disease, to state succinctly the various theories regarding it, and to give the latest views of its Morbid Anatomy and Treatment, has not been an easy task. The library of the Army Museum alone contains *over three thousand* monographs, treatises, and articles bearing upon it. Much that could have been written is unwritten, that the work might be kept within reasonable limits. I have preferred to keep the familiar name, improper though it may be, hydrophobia, as referring to the distinctive disease as it appears in man, and have not discussed Rabies, or the disease as it is manifested in the other orders of the animal kingdom. Such a discussion, as rich in facts and inquiry as is hydrophobia itself

would require a separate volume, and is the proper province of the Veterinarian. As will appear from the credit given, I have not scrupled to draw copiously from such excellent sources of supply as Dr. Dolan's work, *Rabies and Hydrophobia*; from a publication by Flemming, with a similar title; from M. Bouley's and Dr. Russell's monographs; and from such German literature as has been kindly sent me by the United States Consul General at Berlin. My thanks are also due Dr. Fletcher, of the Army Medical Library, for the facilities of investigation extended me. An excellent account of Hydrophobia, together with a full bibliography, may be found in the *Dictionnaire Encyclopédique des Sciences Médicales*, article *Rage*. The History of the Disease is taken from Dolan, Russell, Flemming, and from the reports of the German and Austrian Empires.

Just as this publication was going to press, my attention was called to some articles of very recent date, which are interesting as expressing the latest views of pathology and therapeutics. It is gratifying also to be supported in the theory that I advanced some years ago, that hydrophobia is not primarily a neurosis, but a blood disease—a theory defended for many years by Virchow and other eminent German pathologists. It is my earnest wish that this little book may not be without its measure of profit and interest to physician and layman alike.

1502 14th Street, Washington, D. C.

HYDROPHOBIA.

CHAPTER I.

NOMENCLATURE.

In the Boston *Medical and Surgical Journal*,* Dr. G. B. Shattuck, one of its editors, thus writes, concerning the name *Hydrophobia*, as descriptive of certain symptoms conveyed from animal to animal. "It is unfortunate that age should enforce our respect for the word 'hydrophobia,' although it is less misleading when applied to the disease as it appears in man than in animals. It would be well, therefore, when treating of the disease, to avoid, 'hydrophobia,' as far as the dog is concerned, and to use rather the word rabies."

Dr. W. A. Hammond expresses himself similarly:† "Although there are objections to the name employed to designate the terrible disease I now propose to consider, the same is true of all other terms which have been applied to it, and the present has the advantage of being well known. So long as we are obliged, through ignorance of pathology and morbid anatomy, to use a nomenclature based on symptoms, we must expect to be inexact. The name hydrophobia is as old as Galen, and still retains its preëminence, notwithstanding the fact that the symptom on which it is based is sometimes absent."

* Boston *Medical and Surgical Journal*, Feb., 1878.

† *Diseases of the Nervous System*, New York, 1876.

In the Latin monographs of the middle ages the name *rabies canina* was the one in common use, expressive neither of symptoms nor of pathology, but referring solely to the origin of the disease. Only exceptionally was it the case that any distinction was made between *rabies canina* and *hydrophobia*. In the French literature upon this subject *rage* and *hydrophobie* are used synonymously. In Germany it is customary to speak of *lyssa des hundes*, and the word *lyssa* is frequently met with among English and American writers. It is the misfortune of medical science, that it still adheres to a nomenclature of disease which found origin in popular superstition, or in mere symptomatology, without regard to cause. Recent enlightenment has done much to revolutionize the subject, and the time may not be in the far future when diseases will be classed and named in accordance with special pathological changes.

In many morbid conditions, but more especially in *hydrophobia*, would this change be attended with difficulty, since the peculiarity of the disease depends upon "the distribution rather than upon the character of the microscopical lesions."* The name *hydrophobia* is an improper one, chiefly because the symptom to which the origin of the word refers is not a constant one. They who build upon the shifting sands of empiricism, and count it as a divine interposition that any disease should not conform to the evidences of popular prejudice, or to the received symptomatology of ignorance, might negatively be the innocent cause of suffering, by failing to recognize a case

* Dr. Gowers, *Pathological Transactions*, for 1877, London [vol. xxviii].

of hydrophobia in those conditions wherein the "dread of water" is absent. Fleming,* than whom few have written more clearly upon this disease, says: "We have said that the disease is popularly, but erroneously, designated hydrophobia." This term, which literally means "dread of water" ($\delta\delta\omega\rho$, water and $\phi\omicron\beta\omicron\varsigma$, fear), is only applicable to what is sometimes a symptom of the malady in mankind, the aversion to water or other liquids being but seldom, if ever, observed in any of the animals affected, and it is even more rare in man; besides, it is not a special or characteristic symptom when present, as a repugnance to fluids is occasionally witnessed in various affections, such as phrenitis, hysteria, gastritis and other disorders of the human species. The apparent dread of liquids in general is merely the result of an instinctive dislike induced by difficult and painful attempts to swallow, and this dislike is exaggerated in man—in which the symptom is most marked—by the imagination, when fluids are attempted to be swallowed, or at the sight or even thought of these, which causes spasms of the pharynx, œsophagus, and adjacent organs. The designation is, therefore, and particularly with regard to the lower animals, inappropriate, and is liable to mislead and prove most dangerous if its literal meaning be alone relied upon to distinguish the disease from other maladies. And even the dread, when present, is not confined to water, but to all fluids indiscriminately; a circumstance which has led to the term *Hygrophobia* being proposed, instead of hydrophobia. The condition of intense terror and the fear of everything, animate as well as inanimate, which so

* *Rabies and Hydrophobia*: George Fleming, London, 1872.

painfully marks the course of the disease, has induced others to name it *Pantephobia*; while the peculiar nervous excitability which is developed, even by a current of cold air passing over the patient, caused the ancient medical writers to particularize it as *Ærophobia*. From a morbid supposition sometimes present in the mind of the suffering individual, that he was personally identified with the dog, the malady was at one time named *Cyanthropia*, and at another period *Cynolyssa*, from the fact that the bite of a venomous animal tormented or harassed. By others it has been proposed to name it *Dyscataposis*, a difficulty in swallowing, with symptoms of choking; also *Phobodipsia*, *Erethismus hydrophobia*, *Clonos hydrophobia*, and *lyssa canina*.

The ancient Greeks termed it *lyssa* (λύσσα) or *lytta* (λύττα), and the Romans *rabies*. Pliny speaks of it as the *rabidus canis*; Cicero says, “*Hecubampatant propter animi acerbitem et rabiem in canem esse conversam*;” and elsewhere “*Iracundie et rabie se facere aliquid*.” Horace alludes to it as the *canis rabiosa*, and the “dog days” as the *rabiosa tempora signi*; and Ovid has the expression “*rabiem collegit dolor*.” The term “rabies” strictly implies fury, madness, fierceness, etc., but it has also been employed to denote poison. Thus Seneca says, “*Sparge intentam rabiem draconis*;” other authors at this early period employed the term “rabies” to designate this particular disease of dogs and other creatures, and in recent years it has been generally adopted by veterinary writers. It is certainly a much better appellation than that of “hydrophobia,” inasmuch as, if not absolutely correct in its definition of the nature or character of the

affection, it does not mislead, nor is it likely to give rise to serious blunders. Besides, it must correspond with the term "mad" we usually apply to the animal suffering from the malady, and which finds its equivalent in the French *rage*; the German *hundswuth*, *tollwuth*, *wuthkrankheit*, *hundtollheit*; the *arrabiato* or *rabbia* of the Italians; the Spanish *rabioso*, or *mal de rabia*; and the *turbarea* of the Roumanians. Linnæus divides the disease into two distinct genera, if we may use the expression, viz., "rabies" and "hydrophobia." The first he defined in these words: "*Desiderium mordendi lacerandique innocuos*; and the second, *Aversatio potulentorum cum rigore et saidiasi*, adding *sæpius præcedenti maritala*." Dr. Thomas M. Dolan gives the following synonyms: Lyssa, Kuno-Lyssa, Phobodyson, Phangydron, Rabies canina, Rabies contagiosa, Entasia Lyssa, Canine madness, La Rage (French), Die Hundswuth, Tollwuth (German), Rabbia (Italian), Hydrophobia (Spanish), Val-lenskrack (Swedish), Vandsky (Danish), Byechenstro (Russian), Byesnania (Servian), Wscieklizna (Polish), Wlekklost (Bohemian), Sag düränah (Persian and Turkish), Kelevschote (Hebrew), etc.

CHAPTER II.

HISTORY.

Hydrophobia* is a disease to which not only the human species, but probably all of the brute creation are subject. In examining history we find that the Hebrew writers are altogether silent with regard to it, and we can discover only rare allusions to it among other authors previous to the Christian era. Such references, however, are sufficient to indicate that, although it may not have been so prevalent among the nations of antiquity as among those of more modern periods, yet it was in very ancient times recognized as a peculiar disorder infesting certain animals, and even man himself.

The earliest distinct mention of the disease occurs in a Hindoo medical work of great antiquity, dating probably as far back as nine or ten centuries before Christ, written by a renowned physician named Susruta.† It is observed therein that when dogs, jackals, foxes, wolves, bears or tigers become rabid, they foam at the mouth, which remains open, and from which flows saliva; their tails hang down; they do not hear or see well; they snap at and bite one another, and thus communicate the same malady. The symptoms of hydrophobia in human beings who have been bitten are likewise detailed briefly, and are said to terminate in convulsions and death. Scarification of the wound and burning it with boiling *ghee*—a sort of oil

* Report of Charles P. Russel, M.D., Sanitary Insp., New York.

† Wise. *History of Medicine*.

made from butter—are recommended, as well as various antidotes to be subsequently administered. This concise and remarkably accurate description of the affection, with suggestions for treatment, may be regarded as an epitome of all ancient and modern research upon the subject.

Homer is supposed, by some authors, though without much reason, in my opinion, to allude to hydrophobia in *Iliad*, where Hector is compared to a raging dog. Fleming, after quoting largely from the *Iliad*, thinks it more than probable, from the terms employed, *κυγα λυσσητηρα, κρατερη δε ε λυσσα δε θυχεν*—ο λυσσωδησ λυσσα δε οι χτηρ, etc., that Homer was acquainted with the malady. In regard to the early history he writes, “Plutarch asserts that, according to Athenodorus, it was first observed in mankind in the days of the Asclepiadæ, the descendants of the God of Medicine, Æsculapius, by his sons Podalirius and Machaon, who spread through Greece and Asia Minor, as an order of priests, prophets and physicians, preserving the results of the medical experience acquired in the temples as a hereditary secret. They were the earliest physicians known to us, and it is not unlikely that they may have been the first to observe the madness of dogs transmitted to mankind. And Pausanias, in his *Travels in Greece* (Book ix, 2), alluding to the story of Actæon, the son of Aristæus and Autonœ, who was torn to pieces by his own fifty dogs, because he surprised Diana and her attendants at the bath, was of opinion that the only foundation for the myth arose from the circumstance that the famous hunter was destroyed by the dogs when they were rabid.”

There are two passages in Hippocrates which appear

to indicate that the physician of Cos had observed its characteristic symptoms in man, but failed to regard it otherwise than as a variety of idiopathic phrenitis. His cotemporary, Democritus (the laughing philosopher), however, who was a famous traveler, had probably encountered the disease in foreign parts, as he was evidently well acquainted with its most striking peculiarities. We are informed by the distinguished Roman physician, Cœlius Aurelianus, that Democritus, in a treatise upon opisthotonos, had described the affection in the human subject, admitting its origin from rabid animals, but considering it simply as a form of tetanus. Theocritus and Plato refer to rabies among wolves. Aristotle, in his *History of Animals*, remarks that dogs are afflicted with madness, quinsy and gout; that the first renders them furious and inclined to bite other animals, who thereupon also become rabid; and that all animals, *except man*, are liable to be seized with and destroyed by the malady so engendered. The physicians Artemidorous, Gaius and Asclepiades, also mention the disease, and it is alluded to by Zenophon and Epicharmus.

In the early portions of the Christian era references to the affection by physicians, poets and other writers, became more frequent. M. Artorius, the friend and medical attendant of Augustus, speaks of it, in a treatise upon the subject, as being situated in the stomach. Gratius Faliscus, a poet of the same period, describes rabies, in a work entitled the *Cynegeticon*. Virgil, in his *Georgics*, classes rabies among the distempers of cattle and sheep, induced by a pestilential condition of the atmosphere. Ovid speaks of a rabid she wolf, and rabid centaurs, and

Pliny of the bite of a mad dog. Horace employs the expression *rabies canis*, in a figurative sense, applying it to the fierce heat of the dog star. The disease is mentioned by Columella, a writer in husbandry, in the first century, who alludes to an opinion common among shepherds, that a dog may be ensured against rabies by biting off the last bone of its tail on the fortieth day after birth.

This is still a popular superstition among dog fanciers in some countries. Suetonius refers to wild animals affected with madness. Eumedes, a physician in the reign of Tiberius, makes some interesting observations upon the disease, remarking that even the shedding of tears will excite spasms in an affected person.

Dioscorides, in the time of Nero, appears to be the first who claims to have actually treated the disease. Both he and Galen describe it as attacking animals and men, and agree in the opinion of its communicability from the former to the latter by contact of the morbid saliva with the second skin. But Galen and Celsus as well concern themselves rather with the prevention and treatment of hydrophobia than with its history and progress. Their cotemporary, Magnus, of Ephesus, locates the affection in the stomach and diaphragm. According to Plutarch it was not until the time of Pompey the Great that the rabific poison first began to manifest itself among human beings. Andreas of Caryste, a physician of the Alexandrian School, has left a work upon the disease which he terms *νογολυσσος*. Coelius Aurelianus, already mentioned, a distinguished physician of the reign of Trajan or Adrian, or perhaps as late as the fifth century, is the first to furnish an accurate detailed description of the affection in

man, and of the various controversies regarding it. He mentions it as being endemic among animals in Curia and Crete.

About the same period the affection is treated by a number of other medical men. (Ætius, a Mesopotamian doctor of the sixth century, is the first to furnish anything like an accurate description of rabies in dogs.) A century later the physician, Paulus Ægineta, gives another excellent account of hydrophobia. Among the Arabian physicians, Yahia Ebn—Serapion, Rhazes Africanus and Avicenna, mentioned the disease, the latter terming it simply “*canis rabidi morsus*.” Since the time of Paulus Ægineta we find the affection described by numerous European writers. (Fleming recounts the following curious history of a case of rabies in a bear, recorded about the year 900.) At that time immense forests covered Burgundy, Maconnais, Brescia and part of Lyonnais, which were infested with wolves, wild boars, and other ferocious animals. One day a bear, following the course of the river Saone, at last arrived at the quay of Lyons. Everybody fled except some boatmen, who, armed with heavy sticks, attempted to kill it. The bear, little intimidated by their number, rushed among them and bit about twenty. Six of these persons were shortly afterwards smothered, in consequence of fearful madness. The other fourteen, however, had thrown themselves into the river, to escape the animal’s attack, and, it is affirmed, were thus preserved from the effects of the poison by its being washed out of their wounds. (In 1026 an outbreak of rabies among dogs in Wales is mentioned, in the laws of Howel the Good.) From that time it appears to have

been well known in England, numerous specific remedies, charms and incantations against it being recommended in old Anglo Saxon manuscripts still extant.

Youatt* gives the following from the very original works of Jacques du Fouilloux, "a worthy cynegetical writer of the sixteenth century."

"AUTRE RECEPTE PAR MOTS PRESERVANTS LA RAGE.

"Ay appris vne recepte d'un gentil-homme en Bretagne, le quel faisoit de petits escriteaux, on n'y auoit seulement que deaux lignes, lesquels il mettoit en vne omellette d'œufs, puis les faisoit analer aux chiens que au Orient esté mords de chiens enragez, et auoit dedans l'escriteau *Y Ran Quiran Cafran Cafratrem, Cafratrosque*. Lesquels mots disoit estre singuliers pour empescher les chiens de la Rage, mais quant à moi ie n'y adionste pas foy." And he goes on to say that while he cannot credit the above, yet we may place implicit confidence in his own prescription. "Baing peur lauer, les chiens, quand ils ont esté mords des chiens enragez, de peur qu'ils enragent. Qvand les chiens sont mords ou desbrayez de chiens enragez, il faut incontinent emplir vne pippe d'eau puis prendre quatre boisseaux de sel et les ietter dedans, en meslant fort le sel avec vn baston pour le faire fondre soudainement. Et quand il sera fondu faut mettre le chiens dedans, et le plonger tout, sans qu'il paroisse rien, par neuf fois; puis quand il sua bien laué, faut le laisser aller celà l'emperchira d'enrager."

Fleming quotes from a manuscript of the fourteenth century, published by Hofman (*Fundgruben, Book 1, p. 324*).

"Wilt er einen wirtenden hunt erkennen, so merke wenn er loufet mit ofenen munde, unde mit uzgehangener Zungen, Swenne er sich anseifert unde den Zagel under bei bein smuget unde sins selbes schin an billet, Swenne er ander hunde rluhet, willter wizzen wen ein wutender hund gebizzen hat, so nim des blutes, daz ur der wunden gêt, unde strich daz an ein brot unde wirf ezernein hunde; rluhet ez der hunt; so ist jener hunt wutende gewesen, der

* *Youatt on the Dog*, Philadelphia, 1847.

die gebizzen hat. Swen ein wutendee brizet dem troumet grewlichen, unde zumet ane schulde, unde sihet allez hinter sich unde mac nicht erliden daz man in ain sihet, under wrechtet daz wazzer unde swenne er ez an sihet, so billet er als ein hunt. Wilter ein zu helfe kumen, so tu im di wunden uf mit ysen oder mit fuer, daz daz eiter uz rliez mit dem blute. Setze im egeln un di wunden di daz eiter uz Zehen. * * * * * Ein gebrante hundes leber gipim Zizzen. * * * * * Gegendes menschen biz vrumet kelber bein, so si gebrant werden unde gepulrert und mit horrige getempert so sal man si legen uf den biz."

One of the earliest reports of scientific interest refers to wolves afflicted with hydrophobia in Franconia, Germany, in 1271. More than thirty shepherds and peasants fell victims to their attacks. In 1500 Spain suffered from the ravages of canine madness. In 1532, a rabid dog is said to have strangled the Cardinal Cresence, the Legatee of the Pope, at the Council of Trent. According to Foster there was an epizooty of rabies among dogs at the same time with the epidemic plague in Flanders, Turkey, Hungary and Austria, in 1586. Bauhin informs us that in 1590 it appeared in an epizootic form among the wolves of Monthelliard, and in 1604 it was widespread in Paris. In 1691 dogs in great numbers became mad throughout Italy, and in 1708 it was epizootic among dogs in Suabia. Fleming states that in 1712 wild beasts of all kinds perished in large numbers at Somogy, Hungary, and in the woods the country people found dogs which had been driven there by madness. Men bitten by them were quickly seized with frenzy and hydrophobia. From 1719 to 1721 severe outbreaks of the disease took place in France and Germany, and in 1722 and '23 it pre-

ailed in Silesia, invading Hungary, and it visited other portions of Europe in 1725 and 1726. Dogs, wolves, and wild animals generally, were affected, particularly in Silesia and Lusatia.

The disease, according to Huxham, prevailed in England in 1734-5. Hughes, in his *History of Barbadoes*, narrates that in 1741 many dogs went mad in those islands. The county of Fife, Scotland, was infested with mad dogs in 1748. In 1752 numerous mad dogs were reported about St. James, London, and orders were issued to shoot all that appeared. According to Layard, London again suffered from the disease between 1759 and 1762. In 1763 it broke out among dogs in Italy, France and Spain, and in many places all dogs were slaughtered. In Madrid 900 were killed in a single day. (Rabies was alarmingly frequent among dogs and foxes in Boston and its neighborhood in 1768, '70 and '71, when it was then regarded as a novel disease.) Lipscomb says that the disease was very general in England in 1774. From 1776 to '78 it reigned almost continually in the French West Indies, the true disease never having been observed there before. (In 1779 it was very common among dogs in the city of Philadelphia and in Maryland, and in the same year it affected wolves in Belluno, Italy, and about Bourges, France.) In 1783 it made its advent in the island of Jamaica and Hispaniola, as a very serious epizootic. (In 1785-6-9, canine madness was extremely prevalent throughout the United States.) In 1788 it raged in England. From 1785 to '89 various portions of Europe were afflicted, the country people being terrified by numerous rabid

wolves. In the latter year the disease was particularly prevalent in Munster, Westphalia. (In 1797 it was epizootic in Rhode Island, U. S.)

About the commencement of the present century it was noticed that foxes began to suffer frequently from rabies. In 1803 these animals were running mad in large numbers through the Pays de Vaud, and in the Aubonne, Orbe, Cossenay, and Yserden districts, at the foot of the Jura. In 1804 similar outbreaks of vulpine madness occurred on the northern shore of the Lake of Constance, and thence extended through Germany. This epizooty continued more or less until 1837, attacking the foxes of Wurtemberg, Baden, Bavaria, the upper Danube, the Black Forest, Forest of Thuringia, Jena, the Voralberg, Upper and Lower Hesse, Hanover, Hohenzollern, Rottenberg, and Ulm. At this period badgers were also observed to be affected. We are informed by Blaine that in 1806 rabies in the dog so abounded in the neighborhood of London that scarcely a day passed without his being consulted about one or more cases, and sometimes he attended three, four, or five a day, for weeks together. From that period until 1823 it prevailed every year in London and its suburbs. The most memorable period in the records of hydrophobia was between the years 1803 and 1830, when it appeared to an unheard of degree in many portions of both Europe and America.

In the summers of 1803 and 1804, during the presence of excessive heat, and after long continued warm weather, it broke out upon the northern coast of Peru. It is described as it prevailed in that country by Prof.

Unanue, Proto-Medico. His account, though somewhat highly colored, is, nevertheless, extremely interesting. He informs us that the disease became general among quadrupeds, attacking them indiscriminately; but fixing itself especially upon dogs. The dogs exhibited the ordinary appearances of the affection. The cats ran about with hair erect. The horses and asses were arrayed against each other. The cattle leaped furiously, and engaged in hostile encounters. The disease, engendered, as the professor believed, by atmospheric conditions, was subsequently propagated by specific contagion, spreading into the interior of the country. It proved fatal to many of the inhabitants of Arequipa and Ica, carrying off forty-two persons in the latter town alone. In one instance, twelve fell victims out of fourteen bitten by a single dog. The largest number of deaths occurred in from twelve to ninety days after the bite. The affection would, therefore, appear to have been of a more virulent character than usual. It is likewise related that a number of slaves upon a sugar plantation contracted the disease by feeding upon the beef of rabid cattle, a statement which we can hardly accept as true. Gohier alone mentions similar instances. He states that he has seen hydrophobia in dogs result from eating the flesh of a rabid dog in one instance, and of a rabid sheep in another. But a large number of experiments by Hertwig would seem to prove the innocuousness of such food.

About the same period hydrophobia was noticed to be remarkably prevalent in many portions of the United States, where the medical literature of the time abounded with accounts of cases and discussions as to the character

and treatment of the disease. In 1810 Southern Russia was scourged by the affection. In Prussia, between 1810 and 1819, its human victims amounted to 1635, a large number of whom owed their deaths to the attacks of rabid wolves. In 1815 it prevailed in Austria, and at the same time, according to Viborg, it raged in Copenhagen. In Podolia, in 1818, Marochetti, a celebrated Russian physician, attended no fewer than twenty-six cases of hydrophobia in the human subject, and shortly afterward announced to the medical world his so-called discovery of *Lyssi*, which created a great sensation. According to his description the hydrophobic virus, after the bite of a rabid animal, is transported to and deposited in the orifices of the secretory ducts of the sublingual glands, beside the frenum linguæ and upon the lateral parts of the inferior surface of the tongue, where form a number of vesicles or pustules of variable size, in which, by means of a probe, fluctuation can be detected. It cannot be determined precisely when these pustules appear—ordinarily between the third and ninth days after the bite—sometimes the twentieth day, or even later. If the poison in these pustules be not destroyed by cauterization during the first twenty-four hours of their appearance, it will be removed from them by resorption, producing metastasis to the brain and nervous system, with resulting hydrophobia. Thus, according to Marochetti, the virus does not remain in the wound where it was originally deposited, but is quickly conveyed in all its integrity to the sublingual glands. According to this physician, similar appearances are to be found in rabid dogs and other animals.

In 1822, Magistel, a French doctor, was said to have confirmed the existence of these pustules in several cases coming under his observation; but, notwithstanding the treatment recommended and applied, five out of ten persons bitten by one dog were seized with the malady and died. The truth is, as Watson observes, that the mucous follicles of the mouth, and those at the base of and particularly beneath the tongue, are commonly exaggerated in both men and dogs laboring under the disease; and these enlarged follicles were regarded by Marochetti and Magistel as a specific eruption furnishing the virus and pabulum of this complaint. In 1819 rabies prevailed in Canada, whose Governor-General, the Duke of Richmond, fell a victim to it, having been bitten by a captive fox. In 1820, as Blaine informs us, rabies canina was again rife in England, and continued alarmingly prevalent for a number of years. In 1822 it was common in Holland. In 1819 and 1829 Italy suffered from the disease; and Brera mentions the circumstance of a wolf's having communicated it to nine persons out of thirteen whom it had bitten. The period between 1819 and '27 is particularly noticed by Wirth as remarkable for the prevalence of rabies among the foxes of Switzerland and Germany, and those animals infected large numbers of dogs, cats, horned cattle, horses, pigs, goats, and sheep. Notwithstanding their natural shyness, the mad foxes boldly faced and followed men and animals in order to attack them. In 1824, throughout many districts of Russia, and extending thence into Sweden and Norway, the disease prevailed extensively among foxes, wolves, dogs, cats, and reindeer.

In 1828 its human victims in England and Wales amounted to twenty-eight. In 1829, according to the Veterinary Professor Prinz, it was destructive in Dresden. From 1823 to 1829, as Hertwig informs us, it was unusually common in Berlin, and as Böhme states, in Saxony, also.

In 1830 the subject of hydrophobia had so alarmed the public mind that the House of Commons thought fit to appoint a select committee to investigate it. Evidence was furnished by many eminent physicians, surgeons, and veterinarians, among whom may be mentioned Sir Benjamin Brodie, Mr. Benj. Travers, Mr. Morgan, of Guy's Hospital, Mr. Earle, of St. Bartholomew's, Prof. Coleman, and Mr. Wm. Youatt. Mr. Earle presented positive proof of the undue prevalence and increase of the disease in England during his time, remarking that he had witnessed twenty-five cases in the human subject within as many years, whereas his father had seen but one in fifty years of previous practice. Mr. Youatt testified that he had recently applied lunar caustic successfully to some four hundred bitten persons, and a surgeon of St. George's affirmed that he had similarly treated four thousand without an accident. During the second quarter of the present century, as compared with the first, there ensued a decided abatement of the disease in England, owing to the creation of the dog tax, and the enactment of other laws calculated to decrease the number of worthless curs. In Vienna, in 1830, there were reported, in rapid succession, thirty-nine cases of rabies in the dog. It then almost disappeared until 1838, when one hundred and seventeen

cases occurred. In 1839 there were reported 63 cases ; 317 in 1840, and 141 in 1841. Of the last, only fifteen were bitches. The largest number of cases were noticed in February and May, twenty-one respectively, and the fewest in September, November and December. Between 1830 and 1847 there were 1038 human victims to hydrophobia in Austria. In 1831 and '32 canine rabies was widespread in the Duchy of Prosen. In 1833 it existed to an alarming extent in Barbadoes. In 1834-35 it prevailed in Saxony, Pomerania and Switzerland. In 1835 it was frequent in Chili, South America. In 1836 it was seriously prevalent in Paris, and in 1839 to '42, according to Prof. Rémy, the disease was epizoötic among the foxes of Wurtemberg, and was by them communicated to many dogs, and a large number of the latter animals were thus affected in Baden. Between 1840 and 1842 the malady appeared in the various departments of France, being particularly destructive in Lyons and its vicinity.

In May, 1844, great numbers of mad dogs were seen in Roscommon, Ireland. In the same year it made its first appearance in Malta, and became very serious. In 1851 and 1852 there was a terrible epizoötic of canine rabies in Northern Germany. In 1852, in the small town of Adalia, Turkish Provinces, a mad wolf bit 128 persons and a great number of cattle. In 1858 hydrophobia became so destructive in Algeria, that the Governor-General was compelled to issue a circular relative to preventive measures. From 1855 to 1860 the disease was common in England, in Northern Germany, in France and in Spain. In 1860 it prevailed very exten-

sively among dogs, and was very destructive to cattle in Ohio and Missouri. Between 1860 and 1862 numerous cases of hydrophobia communicated from dogs to natives, occurred in China, at Tietsien, near Peking, and at Canton, while about the same period the presence of rabies was more than usually noted in Vienna and Rhenish Prussia. According to Sir Samuel Baker, the disease was epizootic in Abyssinia in 1862. In Bavaria, between 1873 and 1867, there was a yearly average of 800 cases of hydrophobia in a total of 275,000 dogs. From 1863 to 1867 it was very prevalent in Saxony also, where, in the last three years of that period, there were reported 764 cases of canine madness. It created much alarm in Lancashire, England, in 1864. In 1864-5 the city of Lyons was thrown into great excitement on account of the terrible frequency of this redoubtable disease. In 1865 it was unusually common in the vicinity of London, and during the next year it assumed formidable dimensions in England. In 1866 it was epizootic in Athens, Greece. In 1867 the English dogs at Shanghai, China, were seriously affected, and a number of persons were bitten, with fatal results. In 1868 many mad dogs were seen in Belgium, a country usually exempt from the affection. In 1869 the disease was rife in Paris. In 1870 canine rabies created great terror in the north of England, and it has prevailed very constantly in that country up to the present time. Fleming remarks that the wide and serious extension of this epizooty over the country appears to have been largely due to the insufficiency of the police measures adopted in the different towns and districts, the late period at which they were

introduced, the want of a proper and uniform sanitary organization to combat the spread of this and other contagious diseases of animals, and the general ignorance prevailing with regard to its symptoms and nature." In 1871 hydrophobia was remarkably fatal in Barbadoes. Cœrtel reports a severe epizootic of the disease among foxes in Carinthia, 1866 to 1872.

In France, between 1854 and 1860, the number of deaths were computed by the Minister of Public Works at 1000. In Prussia, from 1810 to 1819, there were 1635 deaths, and 1073 from 1820 to 1834. In Bavaria, between 1839 and 1847, the mortality was 39. The Austrian Empire suffered severely during the period from 1830 to 1847, when 1038 persons succumbed to hydrophobia. In Sweden the mean annual death rate at four different periods of the disease was: 58 from 1778 to 1785, 138 from 1786 to 1790, 6 from 1831 to 1835, and 42 from 1856 to 1860. In Belgium, between 1856 and 1860, there were 26 deaths. In Algeria, from 1844 to 1863, there were recorded 47 deaths—34 Europeans, 7 natives, 6 nationality unknown. The deaths in England in 1838 amounted to 24; in 1839 to 15; in 1840 to 12; in 1841 to 70; in 1842 to 15; in 1847 to 5; in 1848 to 7; in 1849 to 17; in 1850 to 13; in 1851 to 25; in 1852 to 15; in 1853 to 11; in 1854 to 16; in 1855 to 14; in 1856 to 5; in 1857 to 3; in 1858 to 2; in 1859 to 4; in 1860 to 3; in 1861 to 4; in 1862 to 1; in 1863 to 4; in 1864 to 12; in 1865 to 19; in 1866 to 36; in 1867 to 10; in 1868 to 7; in 1869 to 18; in 1870 to 32; in 1871 to 56; in 1872 to 39; and in 1873 to 28. In Scotland, between 1855 and 1863, only 12

persons died from hydrophobia, and none in the succeeding three years. According to the National Census, there occurred in the United States during the year ending June 1, 1860, a mortality from hydrophobia of 38. In New York city the following has been the death rate: In 1855 there occurred 4 deaths; in 1856, 3 deaths; in 1857, 2 deaths; in 1858, no deaths; in 1859, 2 deaths; in 1860, no deaths; in 1861, 5 deaths; in 1862, 1 death; in 1863, 3 deaths; in 1864, 1 death, in 1865, 3 deaths; in 1866, 2 deaths; in 1867, 4 deaths; in 1868, 1 death; in 1869, 5 deaths; in 1870, 3 deaths; in 1871, 7 deaths; in 1872, 6 deaths; in 1873, no deaths; in 1874, 5 deaths. According to the United States Census for the year ending June 1, 1870, there had occurred in the State of Louisiana alone, 22 deaths from hydrophobia, in a total for the whole country of 63; of the remainder the States of New York and Pennsylvania each furnished 9."

In the *New York Herald*, of April 23d, 1879, there is recounted an interesting case of hydrophobia, which is quoted under the chapter on "Symptoms." In the same journal, under date of April 30th, 1879, we find the following editorial:—

"Several deaths have recently occurred which the attending physicians describe as deaths from hydrophobia. In every case there was a well-established history of the patients being bitten by a dog, and they died with the symptoms usually described as due to this disease. For doctors, and, unfortunately, for the public, this sequence of facts from the bite to the horrible death is all very real and very regular, and is a constant element of the daily news, despite all the arguments of the extravagant philosophers who maintain that there is no such disease, and that the imagination of the victims is responsible for all. But nobody knows the precise mode by which this virus operates in the system, and nobody con-

sequently knows how to head it off medically; and the empirical system by which in the course of ages every conceivable remedy has been tried has not brought to light one single agent that the physician can confidently regard as a sure resource against this terrible malady./ Many cases have been reported as cured, but nobody knows whether they were cured. The persons may not have had the disease. Every person bitten does not take it; not even every person bitten by dogs certainly mad. In many persons there is a singular resistance to the poison, just as there may be and is an equal resistance to any poison whatever. Every person exposed even to the plague does not take it. We give elsewhere* a communication signed "J. M.," which reports cures in Russia from the inhalation of oxygen. These appear to be clear and authentic histories, and they afford good reason for basing treatment on this plan. Any plan that affords a clear hope is not to be rejected. This treatment would seem to imply that the essential fact in the morbid process is a deoxygenation of the blood; and the blood corpuscles are so affected by the poison that they cannot obtain oxygen as presented in its ordinary condition. All the symptoms are such as would answer to this origin, and the treatment in its ultimate operation analogous to the successful treatment of rattlesnake bites with ammonia."

As an evidence of the anxiety of the laity in regard to hydrophobia, the following has been clipped from the *Herald*, of same date:—

AN ANXIOUS QUESTION.

NEW HAMPTON, N. J., April 28, 1879.

To the Editor of the Herald:—

I had the misfortune to have my little three-year-old girl bitten by a Spitz dog on the face. The dog was not mad, but surly and ill-tempered. I had the wound cauterized in a few minutes after the child was bitten. Does a person bitten by a Spitz dog invariably become attacked with hydrophobia? Some time ago you published articles on the dangers of Spitz dogs, and I appeal to you or your readers to give me information on the subject.

AN ANXIOUS FATHER.

* Quoted under chapter on "Treatment."

In the summer of 1877, a celebrated actress was bitten by a Spitz dog in New York city, and died shortly after, of hydrophobia. The Washington *Evening Star* of Feb., 1879, reports from the Philadelphia *Times* an interesting case in which the little son being bitten by a rabid dog, recovered. The mother, who was also bitten in the attempt to rescue the boy, died shortly afterward, of hydrophobia; while a man, who was bitten by the same dog, on the same day, suffered no ill effects. The *Star* also reports a case occurring in Fall River, Massachusetts, in which one Joseph Passono was bitten by two hounds in the hand and leg. The wounds were cauterized, but the victim died of hydrophobia. During ten years, from 1867 to 1876, inclusive, there were but six recorded deaths from hydrophobia in Massachusetts, and of these, two occurred in 1870, and the other four in 1876.* In France, with a population of 36,000,000, during the six years from 1853 to 1858 inclusive, there were 107 cases of hydrophobia; or one case, annually, for every 2,000,000 inhabitants. In the department of the Seine, with an average population of upward of 1,000,000, during the forty years from 1822 to 1862, there were 94 cases, or a little more than $2\frac{1}{3}$ per annum. In 1878, Madame Bakméteff, the wife of a Russian member of Legation, and the daughter of a Washington lady, returning from a drive in Paris, where she was living, was met by a favorite poodle, who flew at her savagely, tearing her clothes, biting her, and exhibiting all the symptoms of rabies. The wound was cauterized and the lady has never experienced any ill effects. In

* *Boston Med. and Surg. Journal*, Feb. 7, 1878.

the New York *Medical Record*, of March 5th, 1875, Col. Dodge and Asst. Surgeon Janeway report some valuable statistics of the invariably fatal effects consequent upon the bites of skunks in certain regions of the West. "In the especial region of the valley of the Arkansas river, the bite of the skunk is reported to give rise to hydrophobia in man, although the animal itself be in a normal condition at the time, and its bite is followed in the dog by no bad effects."*

The annual death rate from hydrophobia in England and Wales to a million persons, during 1838-1876, was:—†

In 1838, 1.6; in 1839, 1.0; in 1840, 0.8; in 1841, 0.4; in 1842, 0.9; in 1847, 0.3; in 1848, 0.4; in 1849, 1.0; in 1850, 0.7; in 1851, 1.4; in 1852, 0.8; in 1853, 0.6; in 1854, 0.9; in 1855, 0.7; in 1856, 0.3; in 1857, 0.2; in 1858, 0.1; in 1859, 0.2; in 1860, 0.2; in 1861, 0.2; in 1862, 0.5; in 1863, 0.2; in 1864, 0.6; in 1865, 0.9; in 1866, 1.7; in 1867, 0.5; in 1868, 0.3; in 1869, 0.8; in 1870, 1.4; in 1871, 2.5; in 1872, 1.7; in 1873, 1.2; in 1874, 2.6; in 1875, 2.0; in 1876, 1.2; in 1877, —.

Deaths from hydrophobia in Ireland, during each of the years 1838-'75:—

In 1838, 3	In 1839, 2	In 1840, 3	In 1841, 4
1842, 7	1843, 6	1844, 7	1845, 4
1846, 4	1847, 4	1848, 5	1849, 11
1850, 5	1851, 6	1852, 2	1853, 9
1854, 6	1855, 7	1856, 4	1857, 7
1858, 4	1859, 9	1860, 4	1861, 5
1862, 8	1863, 8	1864, 7	1865, 5
1866, 4	1867, 4	1868, 3	1869, 2

* *Boston Med. and Surg. Journal*, Feb. 7, 1878.

† Dr. Dolan, *Op. cit.*

1870, 1	1871, -	1872, -	1873, -
1874, -	1875, 1		

In Scotland, during the years 1855 to 1874, inclusive, there were only three cases of hydrophobia registered.

In Prussia,* according to Dietrich, the number of deaths were:—

In 1844, 20; in 1845, 15; in 1846, 28. From 1820 to 1834, inclusive, there were 1073 deaths from hydrophobia, or about 71 every year.

Austria appears to have suffered severely during the period from 1830 to 1838, and again from 1839 to 1847. The following statement is interesting, as showing the divisions of the empire in which hydrophobia was most prevalent:—

	1830 to 1838.	1839 to 1847.
Lower Austria.....	22	29
Upper Austria.....	7	6
Salzburg.....	0	2
Styria.....	7	4
Carinthia.....	0	1
Carniola.....	0	5
Goertz, Gradis, Istria.....	33	20
Trieste.....	0	1
Tyrol and Voralberg.....	8	9
Bohemia.....	48	34
Moravia.....	18	8
Silesia.....	5	3
Galicia.....	63	81
Bukowina.....	12	24
Dalmatia.....	122	14
Lombardy.....	107	85
Venice.....	54	66
Military Frontier.....	83	57
	<hr/> 589	<hr/> 449

* Fleming, Op. cit.

In the Washington *Evening Star*, of May 9, 1879, we find the following:—

“Hanson Ross, a young colored man employed on the farm of C. F. Billopp, near Upper Marlboro', Prince George's county, Md., died of hydrophobia on Saturday last, in great agony. Ross was bitten on the left hand by a dog, on April 16th. Mr. Billopp scraped the wound and saturated it with ammonia, and it was afterward cauterized by Dr. B. L. Bird. The next day Ross came to this city, where he was treated for about a week, and he returned to his home, Old Fields, Prince George's county, apparently cured. About ten days ago, however, he began to exhibit unmistakable signs of hydrophobia, and it was found necessary to confine him, and he rapidly grew worse until death came to his release.”

Dr. G. McDonald, of Union, West Virginia, read before the Medical Society of Virginia, Oct. 24, 1878, the details of a well-marked case of this malady.

In October, 1878, several cows belonging to a gentleman living near Geneva, Switzerland, were bitten by a dog belonging to the herdsman. This dog was at once fastened, and died in a few days with the characteristic symptoms of rabies. About one month later, three of the cows that had been bitten refused their food, a viscid saliva flowed from their lips, and their bellowing could be heard at a great distance. Shortly afterward some paralysis of the hind limbs was noticed, and on the sixth day they succumbed, paralysis of the entire posterior half of the body being then complete. They were not at all savage, and showed no disposition to bite; but the accidental presence of a dog excited them in an extraordinary manner. At the end of three months eleven had fallen victims to the disease. The period of incubation ranged between one and two months.

CHAPTER III.

PATHOLOGY AND MORBID ANATOMY.

Capiavacci,* an Italian, was the first anatomist, we believe, who published an account of any dissections of this kind. His observations, with those of Zwingems, Brechteld, and other writers, were republished in the *Sepulchretum*, and then collected by Børhaave, and condensed into a single aphorism. "The morbid phenomena discoverable in the body by dissection are generally the organs of deglutition somewhat inflamed, the lungs incredibly distended with blood, the heart full of blood, the arteries full, the veins empty, blood in the arteries extremely liquid, and scarce coagulating in the air; all the muscles, viscera, brain, and spinal marrow drier than usual." (*Aphor.*, 1140.) Morgagni collected the evidence of his time, and after comparing observations with those of Mead, Plancus, Fabri, Brogiani, etc., came to the conclusion that the seat of the disorder was in the nerves and brain. As far as the visible appearances can furnish us with data, the notes of (preceding) statistics correspond in the main with the general observations of experienced pathologists; and though the medulla oblongata, spinal cord, and its membranes, presented no other visible lesion but congestion, yet as the older anatomists did not overlook the possibility of changes — which were not, perhaps, apparent to the unaided vision, but which the microscope might supply — so we may

*Dr. Dolan, *Op. cit.*

more justly adopt this view. Dr. Aitken, we know, suggested such an hypothesis, and before him, Dr. Copland* remarked that the absence of a lesion in these parts has not been satisfactorily shown, and whether the existing lesion be one of an inflammatory character, or one interesting the ultimate structure of these parts in such a manner as to escape the detection of our unassisted senses, there are strong reasons for inferring that some changes actually exist in these situations, though it may not be limited to them, but may extend to the related and associated nerves, and even to the parts supplied by these sources, and by those nerves.

Dr. Holland, of Cork, consulted 393 monographs, besides an immense number of reports in various journals, and selected what he believed 120 cases of genuine rabies. From his notes Dr. Shinkwin published some valuable and interesting lectures in the *Dublin Medical Press* of 1865, and we give an analysis of the pathological appearances observed in these 120 cases.

The diseased condition which most frequently presented itself was a congestive, highly vascular, or inflamed state of the pharynx, which occurred nineteen times, or nearly once in every six cases. He included under one head the congestion (probably venous), the state of injection (probably arterial), and the inflammation of the pharynx, as the recorders did not make any distinction between these three states. Next in points of frequency is a similar state of the mucous tract, bronchi, or lungs, taken either separately or collectively, which presented itself in 18 out of the 120 cases; and passing from the

* Article "Rabies," Copland's *Dict. of Medicine*.

mucous membranes to the state of the brain and its serous envelopes we find they were congested 13 times, or about once in every 13 cases. The mucous membranes and œsophagus were highly inflamed, or vascular, in 12 cases, or 1 in every 10; and descending this tract to the intestines, they are reported as having been distended with gas in 10 cases, or 1 in every 12. Congestion of the spinal cord occurred 7 times; unusual fluidity of the blood, 7 times; congestion of the membranes of the brain without a similar state of the brain substance, 6 times; and *vice versa*, 6 times; while the cardiac end of the stomach presented an inflamed appearance in an equal number of cases, about 1 in every 20. Congestion of the larynx and intestines was noticed 5 times, and all the viscera presented a normal appearance in 1 out of every 24 cases.

Trolliet in "*Nouveau traité de la rage*," gave as the result of his dissections: Extensive mischief in various organs remotely situated from each other, the chief of which are the changes in the mucous membrane of the trachea and bronchi, and the membranes of the brain, especially the pia mater, all of which are infiltrated with red blood, from inflammatory action. The mucous membrane of the bronchi and trachea, covered with a frothy material of a peculiar kind which M. Trolliet supposed to be the seal or vehicle of the specific virus, which, in his opinion, was driven forward into the fauces and intermixed with the saliva by each expiration from the chest. The capillary vessels of the lungs congested, the substance emphysematous, the blood black, uncoagulating, and of an oily appearance; the mucous mem-

brane of the mouth and pharynx of a pale gray and lubricated by a gentle moisture, containing no saliva or any frothy material. The salivary glands, and the substance which covers them, afforded not the slightest vestige of inflammation, nor of any alteration in volume, color, or texture.

Mayo* summarizes the results of *post-mortems*, as follows: A slightly swollen state of the mucous glands at the root of the tongue, and a trifling increase of vascularity, hardly amounting to inflammation, and greater or less in different instances, of the mucous membrane of the epiglottis, particularly at its edge, and of the upper part of the larynx generally. These appearances alone are constant; of those which follow, some are always observed, so that to a certain degree they are alternative. The mucous membrane of the pharynx and of the stomach, one or both, are often inflamed at one or more parts, in patches sometimes of a bright red, generally with less intensity. The membrane lining part of the bronchial tubes often displays a considerable increase of vascularity. There is commonly a slight increase of vascularity in the brain and trifling effusion. Sometimes the anterior aspect of the medulla oblongata has great capillary vascularity, attended even with ecchymosis. Mayo believed it was evident that these appearances, occurring with such irregularity, must be considered as effects, as results of the disturbance of the nervous system, evinced by the convulsive symptoms, although not shown by any appreciable alteration visible to the naked eye. He further believed that this patho-

* *Medical Gazette*, vol. xxix, p. 548.

logical view was just, and was rendered probable by the consideration of cases which approached nearest in their nature to hydrophobia, as varieties of tetanus, and of nervous irritation from poisoned wounds received in dissection.

Romberg* testifies to the following changes: Congestion of the respiratory organs, partial and general reddening of the mucous membrane, extending from the glottis to the finest bronchi; accumulation of frothy mucous fluid, engorgement of the lungs with dark fluid blood containing many air bubbles and lobular emphysema; the cavity of the mouth is generally found to contain much viscid, whitish-yellow mucus. The papillæ of the tongue and the mucous glands of the mouth and pharynx are often much developed and prominent. Some patches of reddening and congestion of the vessels are visible at the pharynx and intestines, and especially in the stomach.

Fleming thus writes, concerning the *post-mortem* changes in dogs: The following may be accepted as the principal lesions noted in necroscopical examination of the bodies of dogs which have died of rabies, some being less frequent and less marked than others, and a few being rarely observed. There is congestion of the brain, particularly at the base, as well as on the spinal cord, and sometimes a serous effusion into these organs. The muscular system shows congestion as well as the cellular tissue, the liver, and the kidneys. The lungs are not unfrequently greatly gorged with blood, as in animals that die of asphyxia. The spleen is also more or less

* *Nervous Diseases*, vol. 2, p. 337.

congested, and frequently enlarged. The blood in the vessels is black and pitch-like, and furnishes little or no clots. The mucous membranes exhibit, perhaps, the most constant alterations. These are redness of more or less intensity, extreme congestion of the vessels, thickening of the membrane, and hemorrhagic effusion to a greater or less extent on its surface.

In the *Centrallblatt für die Medicin. Wissenschaften*, Kolesem Koff reports the result of the examination of ten mad dogs, made in Rudneff's pathological laboratory at St. Petersburg. The parts examined were the cerebral hemispheres, the corpora striata, thalami optici, cornua ammonis, cerebellum, medulla oblongata, medulla spinalis, and the sympathetic and spinal ganglia. The changes were always most marked in the ganglia, and were as follows: 1. The vessels were much distended and filled with red corpuscles. Here and there, along their course, were seen groups of red corpuscles, and round indifferent elements (probably emigrated white corpuscles) scattered in the perivascular spaces. The walls of the vessels were spotted with hyaloid masses of various forms, sometimes extending into and obstructing the lumen of the vessel, like thrombi. Not far from these were collections of white and red corpuscles. 2. There was found to be a collection of round, indifferent elements in general around the nerve cells, sometimes penetrating into the protoplasm of the cells to the number of five or eight, sometimes in such number as quite to displace the cell-protoplasm. The number of migrated cells produced various changes in the form of the nerve elements. The nuclei of the cells

were sometimes pushed toward the periphery by the intrusive elements. In other cases the nerve cells seemed entirely replaced by masses of round, indifferent corpuscles. These changes were seen even in isolated nerve-cells.

In the *Oesterreichische Vierteljahrsschrift für wissenschaftliche Veterinärkunde*, for 1875, there is a valuable report of the cases brought to the Vienna Imperial Veterinary Institute for treatment, including an excellent analysis of the necroscopical examinations. In the *Transactions of the Pathological Society of London*, vol. xxiii, p. 16, 1872, Dr. Clifford Allbutt details the following conditions in the nerve centres of two patients who died from hydrophobia in the Leeds General Infirmary. The specimens were taken from the cerebral convolutions, from the central ganglia, the medulla oblongata, and the spinal cord: 1. Evidences of great vascular congestion, with transudations into the surrounding tissues. In all the gray centres the vessels were seen in various degrees of distention; their walls in many cases being obviously thickened, and here and there were seen patches of nuclear proliferations. There was a diminished consistence of some of the parts, particularly of the medulla. This seemed to be due to serous infiltration and soddening, as has been observed in the dog. 2. Hemorrhages of various size. In many places a refracting material was visible outside the vessels, due, apparently, to coagulated fibrinous exudate. 3. Little gaps, caused by the disappearance of nerve strands, which had passed through the granular disintegration of Clarke. In addition to these appearances in the

nerve centres, an enlarged spleen had been found. In both cases the parts appeared to be affected in the following order, as regards severity: 1. Medulla. 2. The spinal cord. 3. The cerebral convolutions. 4. The central ganglia. This was in accordance with the symptoms presented during life, viz.:—

1. Reflex irritability in the region of the medulla, with no tetanic spasms.

2. Increasing irritability throughout the cord, with semi-tetanus.

3. Delirium.

In the "Proceedings of the New York Neurological Society," July 7, 1874, in the *Physiological and Medico-Legal Journal*, September, 1874, p. 169, also in his work, *On Diseases of the Nervous System*, Dr. Hammond, of New York, gives an elaborate description of the microscopical changes observed in the case of McCormick, who died from hydrophobia, June 25, 1874. These changes were: Fatty degeneration of nerve cells in the cortical substance of the brain, in the roots of the pneumogastric, hypoglossal, and spinal accessory nerves, and in the upper portion of the spinal cord. Dr. Russell, in objecting to these conclusions, says: "Dr. Hammond considers these appearances almost identical with those in two cases examined by Dr. Clifford Allbutt and reported to the London Pathological Society in 1872, in which that observer stated that there had been noticed throughout all the cerebro-spinal centres, in different degrees, congestion, hemorrhages, fibrinous exudations, and "little gaps, caused by the disappearance of nerve strands which had passed through the granular disinte-

gration of Clarke." Dr. Hammond regards his own observations as of peculiar "scientific value in determining the pathogeny of hydrophobia." I am unable to agree with his conclusions, for the following reasons :—

1st. Even admitting (which I do not) that the lesions which he reported were almost identical with those described by Allbutt, a number of other equally minute examinations of the nervous centres and principal nerves implicated have been made in similar cases by experienced observers, *without the detection of any abnormal appearances* in some instances, and only of intense congestion in others.

The conclusion, therefore, seems irresistible, that the morbid changes noted are not *essential* and *primary* factors in developing the train of symptoms, but are, in all probability, *secondary lesions*, resulting from the terrible disturbance which the disease causes in the functions of the respiratory, vascular, and nervous systems. Such phenomena could hardly, therefore, be of any value in determining the pathogeny of the affection, any more than are a thousand and one other morbid changes seen in various organs after death by hydrophobia, and which are well recognized as being merely *consequential* and non-uniform lesions.

The eminent German veterinary professor, Bollinger, in a recent treatise upon hydrophobia (*Ziemssen's Cycl.*), does not hesitate to deny emphatically that any *post-mortem* observations yet made upon either man or beast are of any value whatsoever in tending to elucidate the pathogenic process of hydrophobia. He adds, moreover,

that in herbivorous animals especially, there is a *complete absence of all characteristic changes*.

2. Granular and fatty degeneration of the nerve cells are not uncommon pathological lesions in cachectic conditions of the system which do not present any very definite symptoms. Such conditions might, therefore, *in some cases*, precede the development of hydrophobia, without, however, exerting more than an *auxiliary* influence in its production.

3. Very extensive *post-mortem* researches have been made in cases of rabid dogs, without any satisfactory results. I have already alluded to Bruckmüller's investigations. (Bruckmüller, after the most careful post-mortem examinations of 375 rabid dogs, during a period of twenty years, arrived at the conclusion that the evidence furnished by dissection is of no value in defining or distinguishing the affection, and is worthless as a foundation for any theory.)

According to Röhl, a distinguished German authority, the cadaveric lesions observed in canine rabies offer a certain similarity to those which are the consequence of acute poisoning by narcotic substances. In this connection I may say that upon visiting McCormick, two hours before death, he appeared, both to Dr. Hammond and myself, laboring decidedly under the narcotism of atropine, of which, as I was then informed by the attending physician, Dr. Hadden, several large doses had been administered. The most recent pathological investigations of hydrophobic cases fail to throw any further light upon the question whether the lesions detected in the nervous centres are *pathognomonic* of the disease, or

are merely changes such as might be due to tetanus or any other affection producing intense disturbance of the nervous system. Benedikt, of the Vienna Imperial Veterinary School, availing himself of a long continued epizooty of rabies in and around Vienna, during 1873-4, has made numerous preparations of a number of animals which were affected. The pathological changes were studied by making seven separate vertical sections through the hemispheres; and the alterations were so striking that Benedikt is of opinion they could have been overlooked only through imperfect methods of investigation. In the first place, he notes an abnormal distention of the meningeal vessels, and the accumulation around them and in the meshes of the pia mater of inflammation corpuscles, together with a nucleated exudation. This was strongly refractive of light, was colorless, and under high magnifying powers was seen to consist of punctiform nuclear substance (granular disintegration). Striking changes were observed in the gray matter of the convolutions, and in other parts of the nervous centres. One of the coarser changes was the presence of numerous holes or spaces, which, when magnified eighty or ninety diameters, were seen to be filled with a material which also refracted light. This mass, under high microscopic powers, consisted of a granular or nuclear substance, in which were single hyaloid and colorless corpuscles of the size of the distended nucleus of a blood corpuscle. Inflammatory corpuscles were to be seen in both masses. In the larger spaces nerve cells were found. Benedikt further describes a peculiar condition of the hardened brain, especially in the finer

sections. The slightest pressure forced out upon the surface shining masses which proved to be myelin (colloid?). These were often found lying detached on the surface of the section, and presented a greenish lustre. He states, however, that he has seen the same in *the spinal cord of a horse which had suffered from rheumatic tetanus*, and regarded it as a softening and chemical alteration of the cord. Meynert has also lately made a microscopical examination of the nervous system of two children who died from hydrophobia. The blood vessels of the spinal cord were distended, and their walls were undergoing amyloid degeneration, and the adventitious tissue of some of them showed nuclear proliferation. A portion of the fibres was surrounded by tumefied resisting medullary substance, which was partially in a state of degeneration, and the cylinder axis had disappeared. *These alterations were most conspicuous in the lumbar portion of the cord.* The connective tissue of the posterior portion of the cord was hypertrophied by an excessive enlargement of the stellate bodies. Its vessels were engorged, and in a state of partial amyloid degeneration. Molecular and sclerotic changes had taken place in the nerve cells of the cortical matter. *Meynert considered the spaces or holes observed by Benedikt as a result of the process employed in preparing the specimen for examination.*" Haller asserts that he has discovered in the blood of hydrophobic animals a micrococcus, which, when cultivated, is transformed into a cryptogram, to which he gives the name *Lyssophyton*. This assertion, however, needs further proof.

Of the pathology of hydrophobia, Dr. Hammond

writes : "Is hydrophobia a disease of the nerve centres, or a blood disease? I suppose it is utterly impossible, in the present state of our knowledge, to answer such a question. It may start as a blood disease and end as a nerve disease. Blood diseases lead to structural changes of various organs of the body, and the nerve centres are likewise involved to a considerable extent. Is it not worth while to call attention to the numerous instances of blood diseases which produce structural changes? Hydrophobia may be a blood disease, and yet afterward be succeeded by changes in the nerve centres. It is not necessary to suppose that hydrophobia is a nerve disease from the beginning; it is perfectly possible, however, that it may be, and there are a great many instances which can readily be adduced in proof of this assertion. Take tetanus, for example. Very few pathologists pretend to say that tetanus is a blood disease. It is a disease propagated through the nerve tissues, starting from injury of a peripheral nerve, and inducing structural changes in the spinal cord. Dr. Lockhart Clarke has ascertained in a number of cases that the essential condition of tetanus is a granular degeneration of the cord, and that is probably only the beginning of the fatty degeneration I find in hydrophobia, and yet there is no suspicion of blood poisoning in tetanus. Hydrophobia presents many analogies to tetanus, not only in its morbid anatomy but in its natural history. Epilepsy can be caused by injury to the peripheral nerves. I had a case, some years ago, of a lady who wounded her thumb, and six months afterward she had epileptic paroxysms, which were preceded by an aura originating in the cicatrix.

And if epilepsy, which is another one of the spasmodic diseases, can be induced by a single wound, why not hydrophobia? So that we have examples of analogous diseases caused by wounds of nerves, without the necessity of supposing the blood to be primarily affected. Still, there cannot be much doubt that the poison in the saliva, and not the wound made by the animal's teeth, is the essential influence producing hydrophobia. It is not at all certain, however, that the latter may not, in some cases, produce a modification of the characteristics of the disease, perhaps causing those tetanoid phenomena which are occasionally present. The nature of the virus is unknown. It is probably of the nature of a ferment; but this cannot be satisfactorily proved."

"Trollet* maintained that the saliva *per se* possesses no contagious quality; only so when mixed with the frothy material driven out from the bronchi, which constitutes the vehicle transmitting the virus. His opinion was founded upon the absence of any evidence of disease in the salivary glands, upon the morbid changes always existing in the bronchi, and upon analogies furnished by other contagious diseases, as gonorrhœa, smallpox or syphilis. His distinction, however, is of no practical importance. Magendie considered that he had demonstrated the non-inoculability of the disease by any other material of the animal's body than the saliva; but Hertwig has since apparently proved, by experiment, that the blood, and therefore most of the tissues, contain, to some extent, the poisonous element. The saliva, as demonstrated by Hertwig, retains its noxious properties

* Dr. Russell. Op. cit.

for at least fifteen hours after death, and it is asserted by Schenck that the disease has been produced by wounds from sabres with which rabid dogs had been dispatched years previously."

With regard to the "lysses" insisted upon by Marochetti, Fleming says "that they have been sought for in vain by the veterinarians, Bouley, Barthelmy, Renault, Colin, Leblanc, Delafond, Rey, Lafosse, Haubner, Pillwax, Röhl, Eckel and other careful comparative pathologists. Even when they or similar appearances do exist, no value, it would appear, can be placed upon them; as, according to other veterinarians, among them Prinz, —they may be observed in healthy dogs; and Spinola says he has found them in dogs affected with anthrax. Saint-Cyr mentions having found, in a horse that died rabid, the sublingual glands congested, and a patch of ecchymosis the size of a twenty-centime piece at the base of each sublingual duct. Bruckmüller found a deep ulcer at the root of the tongue of a mad dog; in another he observed the lymphatic glands of the throat very red and swollen. And Peuch examined very carefully a dog that had perished from rabies, and found the laryngeal mucous membrane slightly inflamed and covered with mucus. On the right side of the tongue, and a little behind the base of that organ, beneath the epithelium, were two pustules of a white color, and different in size; one was of the volume of a grain of millet, the other smaller. They were surrounded by a slight inflammatory areola, and both showed in the centre a minute opening visible to the naked eye; inspected with a lens, the opening appeared to be that of the lingual

gland. Anteriorly there were four pustules—two on the frænum of the tongue. They were about the size of a grain of millet; each had an inflammatory circle surrounding it, and when they were compressed a few drops of liquid escaped and looked like pus. On the frænum of the tongue of the left side was a seventh pustule, quite isolated, and the most developed and conspicuous. It was as big as a large millet seed, appeared to be perfectly closed, and was circumscribed by the inflamed ring, like the others. The epithelium covering it was thin and slightly raised by a purulent fluid, which was not in sufficient quantity to practice an inoculation with. In twenty-seven examinations of dogs that had died from rabies, Peuch found lesions of the tongue in fourteen, twelve as ulcerations, and two with pustules. In this connection it must not be forgotten that Marochetti did not contend for the existence of the lyssi after death, but only asserted that they were to be searched for during the incubation of the malady—a circumstance that appears to have been overlooked by those who have contended for and against the presence of these vesicles.”

Dr. Coates, according to Dr. Dolan, has described the microscopical appearance in two of the cases which occurred at Glasgow. The coarse examination of the principal organs of the nervous system showed that the veins of the encephalon were distended with blood, that the surfaces of the arachnoid were smeared with blood tinged with fluid over the hemispheres, and that there were a few drachms of similar fluid in the ventricles. Microscopical examination of the cicatrix of the original wound showed that the skin and subcutaneous fat were

infiltrated with round cells; the blood vessels presented in their internal wall transparent globular bodies, like drops of an exuded fluid. In many parts of the cord and medulla oblongata accumulations of round cells were found in the perivascular spaces of the medium sized vessels, and similar cells were also found around the ganglion cells. In all parts of the system there were numerous amyloid bodies, but only one hemorrhage was discovered. Still following Dr. Dolan, we learn that on May 15th, 1877, Dr. Gowers exhibited before the Pathological Society of London an extensive series of microscopical sections, illustrating the changes in the medulla oblongata and spinal cord in four cases of rabies. For two of these, which occurred at Sheffield and Hertford, he was indebted to Lockhart Clarke, and for the other two, to Dr. Wickham Legg. The changes found resembled, in the main, those which have been described by Benedikt as occurring in the convolutions of the dog, and by Dr. Coates in the lower centres in man. In all four cases the vessels of the gray matter were greatly distended, the distention being greater in the medulla, near the gray nuclei in the lowest part of the fourth ventricle. In three of the cases the larger veins in this position presented aggregations of small cells within the perivascular lymphatic sheath. These were, in some cases, as a single layer, in other cases densely packed, so as to compress the vessels they surrounded. In a few places the cells extended beyond the limits of the sheath. In most parts similar cells were scattered through the tissue, among the nerve elements, and in some places, chiefly in and near the hypoglossal nuclei, there were

dense collections of these cells, constituting, in fact, miliary abscesses. Similar smaller collections were seen among the fibres of origin of the hypoglossal and glosso-pharyngeal nerves. Adjacent to many vessels were areas of "granular degeneration." In two cases many of the larger vessels, chiefly veins, contained clots, parts of which were évidently of ante-mortem formation, portions of the clots being different from the rest, darker, granular, or spongy in aspect. By some of these the appearance of embolism was closely simulated. Attention was drawn to the indications of formations *in situ* afforded by the gradation between the normal and the altered clot, and by the curved lines of pressure to which the clot had been exposed immediately after its formation. One specimen presented thickening of the inner coat of a vein, opposite the older part of a clot, and the clot was reduced in size correspondingly, as if formed secondarily to the change in the inner coat of the vein. In this vessel there were round cells in the perivascular sheath, and leucocytes within, accumulated in the old clot and within the substance of the swollen inner coat, affording strong evidence that the cells outside were also migrated corpuscles. The nerve cells presented comparatively slight changes, being merely slightly swollen and granular in some places, and surrounded with granular degeneration here and there. These changes were most intense in and about the hypoglossal, pneumogastrie, and glosso-pharyngeal nuclei, slighter in the nuclei of the auditory, facial and fifth nerves, slighter also in the cord, and still slighter in the upper part of the pons.

Dr. Clifford Allbutt has also found still less definite

changes most distinct in the medulla. In Dr. Gower's cases the change reached its maximum in the region of the "respiratory centre" in the medulla, which includes that prolongation downward of the facial nucleus which subserves the movements of the lips. The paroxysms of hydrophobia are paroxysms of respiratory spasms. In the case in which the change in the respiratory centre was most intense, the paroxysms consisted of spasm of the diaphragm, and an inspiratory effort, in which the clavicles almost touched the lower jaw, and the lips were pressed against the teeth. Further evidence of the over action of the hypoglossal nucleus, in which the changes were so marked, was afforded by one case in which a noise as of the tongue being smacked against the roof of the mouth occurred at the commencement of each spasm. Dr. Gowers concluded by alluding to the difficult question, whether these vascular changes are the initial lesion in the nerve centres, or are secondary to the irritation of the nerve elements by the blood poison. It was certain that embolism played no part in the process; the coagulation in vessels was also not essential, while in one case the absence of cell infiltration showed that dilatation might be the only morbid state of the vessels. On the other hand, the changes in some of the clots, in cases in which the symptoms lasted only three days, showed that considerable vascular changes must have occurred very early in the disease. Though we have acquired new and important data by these observations, and are progressing in, we believe, the right direction to a more complete knowledge of the true pathology of rabies, still we cannot affirm positively

that we have found a characteristic lesion pathognomonic of it. There are many difficulties in the way, and especially incubation, the period of which varies so much, and about which there are so many theories. Dr. Barry, in his *Experimental Researches*, rejects the notion that the hydrophobic poison is taken up and mixed with the blood after the manner of other substances similarly circumstanced, and that it does not produce its peculiar effects until after it has wandered through the *penetralia* during forty days, or longer, as directly opposed to all analogy.

Dr. Dolan thus sums his conclusions:—

1. That the phenomena of rabies, as evinced by morbid anatomy, depend on structural alterations in the medulla oblongata and spinal cord, influenced by a specific virus, the *modus operandi* of which is yet involved in obscurity.

2. That the special morbid appearances found are quite in accordance with this belief in fact.

3. That the absence of some of the special appearances do not invalidate this assertion.

4. That this view is supported by analogy from those diseases with which rabies has been confounded.

5. That further accurate *post-mortem* notes are necessary to fill up the lacunæ, or missing links.

6. That as the microscope has confirmed the accuracy of the hypothesis, and thrown a flood of light on the nature of the structural alterations foreshadowed by the older pathologists, so we may reasonably hope treatment will proportionately advance, and that, guided by the light of a more advanced pathology, we may at least

be able to place rabies in the category of curable complaints.

The question as to whether the lesions of the nerve centres are primary or secondary to a blood poison is as yet *sub judice*, but from a very careful analysis of the various necroscopical reports, I am strongly of the opinion that future investigations will point to the existence of a blood ferment as the exciting factor. That this ferment is of a nature to inhibit the functions of the oxygen carriers of the blood, altering the chemical and physiological character of the red corpuscles and greatly interfering with the integrity of the blood plasma; and just in proportion as we shall direct our treatment to such conditions, by the free administration of pure oxygen, so will the measure of our success be.

CHAPTER IV.

INCUBATION: INFLUENCE OF AGE, SEX AND CLIMATE.

The literature of hydrophobia furnishes us with nothing definite regarding the period of incubation. The duration is exceedingly variable, ranging from three days to seven years. The poison is deposited within the body by means of a wound from a rabid animal, or by contact of the morbid saliva with an abraded surface. The wound generally seems to heal by the "first intention." At this period the virus may lie concealed for a length of time, until some exciting cause sets it free upon its errand of destruction. Watson thinks that it may be inclosed in a nodule of lymph, or detained in temporary union with some of the tissues. Virchow has compared the action of the poison to that of a ferment, fresh particles of which during their liberation from the seat of injury are being constantly conveyed into the blood, producing through the medium of the circulation the specific effect upon the nervous system. From Dr. Dolan we learn "That Dioscorides, *Dios.*, lib. 11, c. 12, says that the symptoms come on in about forty days, but in some cases not until after six months, or even a year, but he mentions writers who assert that persons have been attacked after seven years."

Galen, *Comment.*, 2, tome viii, p. 735, quotes a case with a period of incubation of one year.

Paul Ægineta, *Comment.*, lib. 5, c. 3, gives forty days to six months.

Varignan, *Varig. Tract.*, iii, p. 127, asserts that the poison may remain latent for four days, a week, a month, or six months, or a year.

Fernelius, *De Morbis Cont.*, lib. ii, c. 14, remarks that the effects may be manifested from the twentieth day to a year.

Ambrose Paré, b. 21, p. 505, says that the same poison will manifest itself at different periods in different constitutions.

Vander Wiel, *Observ.*, No. 100, p. 431, agrees in the foregoing.

Claude de Choisel speaks of thirty days after the bite as the usual period, and Dr. Mead, in his work on "*Poisons*," is of the same opinion.

Lommius, *Lommii Med. Obs.*, lib. 1, p. 64, states that the disease has been observed in fourteen and forty days, and after six and seven months.

Morgagni, in *Epist.* viii, sec. 21, relates a case in which the period of incubation was twenty years.

Webster, Hamilton, and Boërhaave mention a similar lapse of time.

Holland, in his *Notes*, and *Shinkwin's Lectures*, *Dublin Med. Press*, 1865, p. 390, arrived at the following calculations, from an analysis of 120 cases:—

The shortest interval between the bite and the first symptom was twelve days; the longest, 334 days; the average period of incubation was sixty-one days, eighteen hours.

The shortest interval between the bite and the death was fourteen days, eighteen hours; the longest, 335½ days; the average, sixty-three days, seventeen hours and twelve minutes

The least number of hours from the occurrence of the first symptom to death, in these cases, were eighteen hours; the greatest interval, 201 hours; and the average duration of the symptoms was seventy hours, forty-eight minutes.

Thamhayn, in *Schmidt's Jahrbücher*, 1859, gives the following periods of incubation in two hundred and twenty cases:—

In	2 cases,	3 days,	in	27 cases,	5 weeks,
"	2 "	4 "	"	37 "	6 "
"	2 "	9 "	"	17 "	7 "
"	3 "	10 "	"	8 "	8 "
"	1 "	11 "	"	11 "	9 "
"	1 "	12 "	"	7 "	10 "
"	1 "	15 "	"	5 "	11 "
"	2 "	17 "	"	12 "	13 "
"	2 "	18 "	"	3 "	14 "
"	4 "	19 "	"	4 "	15 "
"	9 "	21 "	"	7 "	16 "
"	16 "	4 weeks,	"	6 "	5 months,
"	4 "	6 months,	"	3 "	12 "
"	3 "	7 "	"	1 "	15 "
"	1 "	8 "	"	2 "	18 "
"	1 "	9 "	"	1 "	24 "
"	2 "	10 "	"	1 "	26 "
"	1 "	11 "		1 after	14 years.

and 1 after 5½ years,

In the *Encycl. Brit.*, Art. "Hydrophobia," Bondin gives the following analysis of sixty-nine cases.—

In 14, 1 month; in 41, 1 to 3 months; in 8, 4 to 6 months; in 6, 7 to 12 months.

In 147 cases, Tardieu arrived at the following conclusions:—

In 26, 1 month; in 19, 3 to 6 months; in 93, 1 to 3 months; in 9, 6 to 12 months. In the *London Medical Gazette* for 1844, Cæsar Hawkins gives as his analysis of 130 cases:—

In 17, 18 to 30 days; in 23, 60 to 90 days; in 63, 30 to 59 days; in 9, 90 to 120 days. After this he goes on to say, “the symptoms developed at various periods, one or two in each month, the 5th, 6th, 7th, and so on, up to the 19th, the last case occurring under Mr. Nourse’s care. This is the latest time at which rabies can be fairly said to have been known; there is, indeed, a case of Dr. Bardsley, in which it is said to have been produced twelve years before, but it appears most improbable that this was really the case.” He asserted that from six weeks to three months was the time in which almost all the cases of rabies had been seen. In reference to the case of Bardsley, Dr. Elliotson, in the *London Medical Gazette* for 1833, observes that there is a doubt about its genuineness. He believed that the average interval was from one to two months. Elliotson had six or eight cases in London, and mentions the instance of two little girls who were bitten on the face by a rabid dog. At the expiration of from six weeks to two months the girl who was bitten second was attacked and died, but the other sister escaped. Dr. Parry doubts the genuineness of Bardsley’s case. Lawrence, in the *London Medical Gazette*, 1829, tells us that there is a latent period, tolerably definite and regular, resembling, somewhat, that of scarlet fever, smallpox and

measles, and generally speaking, incubation extends between thirty and forty days. He also alludes to the case published by Bardsley in the *Memoirs of the Manchester Literary and Philosophical Society*. Romberg has shown, from an analysis of sixty authentic observations, that the shortest period was fifteen days, the longest from seven to nine months, and the average period from four to seven weeks. He remarks that the same infection presents differences, independent of age, or sex, or the locality of the injury, for in thirteen cases described by Trollet, who had been bitten on one day by a mad wolf bitch, the symptoms developed in—

6 between the 15th and 30th day.

4 “ 30th “ 40th “

2 “ 40th “ 53d “

And in one in three months and eighteen days after the bite.

Fleming informs us that in 224 cases noted in France—

In 40, incubation was less than a month.

In 143 from 1 to 3 months.

In 30 from 3 to 6 months.

In 21 from 6 to 12 months.

The mean duration of the latent period, from Roucher's analysis of cases that occurred in Algiers, has been fifty-one days, the ordinary minimum thirty days, the maximum three months.

Fleming also furnishes us with Bouley's statistics of 129 fatal cases, the period of incubation being given in 106: in 73, rabies developed in 60 days; in 33, up to the eight month.

Trousseau informs us that the disease generally shows

itself in man from one to three months after the infliction of the bite; that cases are rare after three months, and still more rare from the sixth to the twelfth month, and in his opinion, from the statistical observations we have, the authenticity of cases reported as occurring after a year might be almost disputed.

Bouley concludes, from his statistics, that after two months immunity may be looked for, though the danger has not entirely passed away, but the patient may, after a few more months, reasonably entertain sanguine hopes of recovery.

John Hunter says, the longest period of incubation is seventeen months.

Dr. Dolan thus sums up :—

1st. The duration of the latent stage has an indefinite, though, to a certain extent, a regular course, for the majority of cases collected, not only by English, but by foreign observers, prove that the interval has generally been from one to three months.

2d. That age influences the incubatory period, it being shorter in young than in old people. Heming tells us that from an estimate of ages, from three to twenty, and from twenty to seventy-two, it has been found that for the first group there was a mean period of forty-four days, and for the second of seventy-five days.

3d. Having such an almost accurate idea of the average period of incubation, the physician, while not neglecting all reasonable precautions, can hold out reasonable hopes to his patient of an almost perfect immunity after three months, and an increasing hope with every month that passes, so that, after a year, he may afford a

scientific certainty of the patient's safety. In other words, all reported cases of rabies occurring after a year must be looked upon with suspicion, and should the symptoms be simulative, other causes must be assigned, as re-inoculation, etc.

Concerning the period of incubation, Dr. Hammond writes: "the duration of this stage is variable. It is rarely shorter than a month, and probably never longer than two years. Instances are on record, however, in which the disease has been developed within ten days, and others, about which, however, there is much doubt, in which the latent period has reached to ten years and longer. The vast majority of cases occur within seven months after the reception of the wound. In six cases which have been under my observation the period of incubation varied from about twenty-five days to four months and a half. Dr. John Johnston, however, in *Medical Essays*, 1795 to 1805, refers to an opinion that in hot countries the disease has appeared four or five days after the bite, and, in the margin of the page on which the statement is made, Dr. Hosack, to whom the book formerly belonged, has written a note in which he states that it ensued in a child in New York five days after the bite was inflicted."

From an analysis of one thousand and fifty cases, I find that the period of incubation in four hundred and ninety-three cases was within sixty days, and it seems quite probable that Watson was correct in his theory that the virus is shut up in a nodule of lymph, there to remain *perdu* until some exciting cause shall set it free.

Theories of Incubation.—Dr. Dolan has very excel-

lently condensed the literature upon this division of hydrophobia, and from him we learn, "That the virus being introduced into the skin, or through any abraded surface, the natural questions suggest themselves: Does it remain hermetically sealed up for a time? Does it produce a change in the system before the development of the symptoms? Is it a slumbering germ which may be roused into action by various exciting causes? * * Faber imagined the contagious principle became encysted on its introduction, and that it entered the blood under the influence of certain favorable conditions."

Brown-Séquard is of opinion that an alteration takes place in the part of the body bitten by a rabid animal before the characteristic phenomena of rabies appear; that the convulsions follow a kind of *aura*, starting from the wound or cicatrix. He therefore lays the *locus in quo* in the wounded nerves. This theory is negatived by the facts that the nerves have been excised and the limb amputated without benefit, after the symptoms have appeared, also by the fact that in the majority of cases the wounded part shows no evidence of alteration.

Jesse Foote,* in 1788, published a very valuable pamphlet, dedicated to Pott, on the value of excision. He reasoned from analogy, from the bite of a viper, and from experiments made on the guinea pig, that excision would be useful before absorption had commenced. He also drew his inferences from the experiments of the Abbé Fontana, who had made 6000 experiments on the effect of the bites of vipers.

* *An Essay on the Bite of a Mad Dog*, by Jesse Foote, Surgeon, London, 1788.

Dr. Anthony Todd Thompson, in the *Medico-Chir. Transactions*, vol. xiii, 1826, in his comments upon a case of rabies from the bite of a cat, in 1826, threw out the hypothesis that the virus remains dormant in the part where it is deposited by the tooth of the rabid animal, until a certain state of habit rendered the nerves in its vicinity susceptible of its influence, and this being communicated, a morbid action is begun in these nerves, and extended to the respiratory nerves, which induce the whole train of symptoms constituting the disease.

In the *Lancet*, vol. ii, p. 809, 1827, Mysotoxikos tells us that everything leads to the belief that the virus, which has afterward to contaminate the circulation, is generated in the wounded part from the germ first deposited there by the tooth of a dog, just as we see takes place in variola, vaccinia, and syphilis, the period of assimilation being different in all these. But as soon as absorption of this assimilated matter commences, the symptoms of the disease begin to show themselves. He also says that the modern and well authenticated experiments have proved that when a poison, whether mineral, vegetable, or animal, is applied to a wound, the animal is not affected until absorption has taken place, for if an exhaustive cupping glass be placed over the poisoned part, but one minute before the expiration of the time at which the poison is known invariably to produce its effects, the animal exhibits no symptoms whatever.

The experiments of Jesse Foote prove that a guinea pig might be bitten by a viper, and five minutes allowed to elapse before amputation of the part bitten was effected, when the animal survived. Mysotoxikos also

suggested, under the presumptive impression that in rabies, as well as in other varieties of poisoning, the transport of the deleterious matter from the wound into the system and the appearance of the symptoms followed, as cause and effect, some special precautions might be taken, even when the symptoms were pronounced.

When the cicatrix feels at all tender, he advises:—

1. The immediate application of a cupping glass for an hour.
2. The dissection out of the bitten part.
3. The reapplication of the cupping glass for an hour.

Whoever this writer may be, who, fifty years ago adopted this pseudonym, and whose individuality is just as much lost as that of Junius', his views are rational; and though we cannot endorse them in full, yet they present as satisfactory an hypothesis as we can expect, on part of the phenomena. They somewhat resemble the views of Todd Thompson, which have been revived by some modern writers, as Sir Thomas Watson. The wound in the majority of cases does not assume any inflammatory action, nor can we, by the naked eye, discover any alteration in the appearance at the time of the development of rabies. The action of the virus seems most to resemble that of syphilis, in which we have a period of latent action, a period of absorption by the lymphatics, and a subsequent incubatory period of syphilization. Further research is necessary, and experiments with the virus, as dissecting or excising the bitten part, and introducing it into some animals, and then watching its effects day by day.

Now that *bacteriae* play such an important part in disease, we shall expect some results in this direction, and a further explanation of the remaining part of the phenomena.

Virchow, we know, is of opinion that the contagium of rabies has an action similar to that of ferments. This view is a return, to a certain extent, to an old theory. Etmullerus, in 1683, said: "The cause of this disease consists in a certain peculiar ferment, which affects first the spirits and then the blood. This ferment is carried along with the saliva into the wound." That the new elements introduced at the point of inoculation are being continually introduced into the blood, by means of which they act on the nervous system; and that rabies only appears when these elements have accumulated in an excessive quantity.

As Fleming says, there may be a double zymosis, first in the part, and afterwards in the system, the result of which is either to multiply the poison or to increase its virulence. There are many other ingenious speculations, as, for instance, whether the virus is present in the secretion of the generative organ. For man, we may answer by the following statements:—

Chabert relates that a female, the wife of the executioner, contracted the disease. She had cohabited with her husband up to the evening of his being attacked with rabies, due to his having been bitten by a rabid dog.

Hoffman relates a similar case; but Baudot mentions the case of a young woman who had cohabited with a soldier for a month, from the day when he had been

bitten by a mad dog, until rabies manifested itself, without becoming afflicted.

Bonteille, Boissiere, and Rivollier mention cases in which sexual intercourse took place within only six hours of the appearance of rabies, without transmission.

“The most interesting question* in connection with this subject is in reference to the communicability of the affection by the human species. Cœlius Aurelianus relates an instance of a seamstress who became infected by ripping with her teeth the cloak of a hydrophobic patient. Palmarius states that a peasant having the disease communicated it to some of his children by kissing them. Tardieu relates a case of transmission from a shepherd to a sheep. Eckel produced rabies in a dog by inoculation from a locksmith who had hydrophobia. Two French physicians, Enaux and Chaussier, mention cases where persons have become infected by wiping their lips with napkins previously used by hydrophobic patients. In 1830, Mr. Earl, a prominent London surgeon, while administering medicine to a woman who was suffering from the disease, chanced to be bitten by her, and at once proceeded to cauterize the part. On being taunted with unnecessary timidity, he immediately inoculated a number of rabbits with the woman’s saliva, and produced in several of them hydrophobic symptoms and death, while a similar result did not follow inoculation with the normal secretion. The celebrated experiments made by Magendie and Breschet at the Hôtel Dieu, in Paris, in 1813, were no less remarkable. They inoculated two healthy dogs with saliva from a patient

* Dr. Russell, *Op. cit.*

named Surlu, who died of hydrophobia a few hours afterward. One of the animals escaped; the other, carefully secluded, became rabid in six weeks, and having been made to bite several dogs they soon went mad and infected others still. Hertwig also is said to have successfully transplanted the virus from a man to a dog; and Busnont, Berndt, Löffler, and Renault, of Alfort, likewise have demonstrated that the disease is capable of transmission from mankind to the canine race."

SEX, AGE, AND SEASON OF THE YEAR.

The male sex appears to be the most exposed to hydrophobia. In England, from 1847 to 1858*, 133 deaths took place from rabies, viz: 103 males and 30 females. In France, from 1850 to 1859, males 175; females 64. In Bouley's analysis of 320 persons bitten, 206 belonged to the male, and 81 to the female sex; the sex not being indicated in the remaining 33.

In the United States, out of eighty well authenticated cases, from 1849 to 1879, seventy were males and ten were females.

Age.—According to Dr. Dolan, in England, in 1866, the number of deaths being thirty-six, the ages were as follows:—

Years.	Deaths.	Years.	Deaths.
Under 5,	6;	From 25 to 30,	5;
From 5 to 10,	9;	“ 30 “ 40,	2;
“ 10 “ 15,	2;	“ 50 “ 60,	2;
“ 15 “ 20,	4;	“ 60 “ 80,	2.
“ 20 “ 25,	4;		

* Fleming, Op. cit.

Boudin gives the following ages of 136 persons who died from rabies in France:—

Years.	Deaths.	Years.	Deaths.
Under 5,	7;	From 30 to 60,	54;
From 5 to 15,	30;	“ 60 “ 70,	8;
“ 15 “ 20,	15;	“ 70 upward,	6.
“ 20 “ 30,	12;		

Bouley gives the ages in 124 cases, from which we find that the largest number of accidents, 97 out of 174, occurred between the ages 5 to 15. The following is his summary of facts collected from the report made to the Consulting Committee of Public Hygiene:—

“1st. In forty-nine departments wherein rabies are reported by one hundred and eight communications, three hundred and twenty persons have been bitten by rabid animals. This figure is enormous, but must be regarded, nevertheless, as far below the truth, for there are departments where the disease is common, and from which no reports were obtained.

“2d. Out of three hundred and twenty persons bitten, the bites caused hydrophobia in one hundred and twenty-nine cases, or a mortality of about forty per cent.

“3d. Out of three hundred and twenty persons bitten, the wounds were not followed by the disease in one hundred and twenty-three known and specified cases.

“The established rate of innocuousness would, therefore, be about thirty-eight per cent. But we must consider that sixty-eight cases remain, the termination of which have not been reported; a fact which admits the supposition that for a majority of the bitten people, counting in these sixty-eight cases, the wounds had no

fatal results, for the termination by death from a wound by a rabid animal would certainly not escape public notoriety. We may conclude, therefore, that the majority of the cases reported in the investigation, of which the death is not mentioned, the persons bitten have continued perfectly free from the disease.

“4th. Among the three hundred and twenty bitten persons, two hundred and six were males, eighty-one females, and in thirty-three cases the sex is not mentioned. This result is perfectly in accordance with those obtained from previous statistics. The number of females is always much lower than that of males, which can be explained only by the fact that they are less exposed, in consequence of their habits and of their household work, to be met by mad dogs; and when exposed to their rage, the character of their clothing offers a means of protection, for the animal satisfies his fury by biting anything that falls in his way.

“5th. Fatal results have not been equal in both sexes. Out of two hundred and six male cases, one hundred, or a little less than half, died; while out of eighty-one female cases, twenty-nine, or a little over one-third, proved fatal. This is forty-eight per cent. in the former, and thirty-six per cent. in the latter case. These figures, however, carry with them nothing conclusive.

“6th. The age is indicated in two hundred and seventy-four cases, the subdivision of which into a decimal series, shows these interesting facts: The greatest proportionate number of bites (namely, ninety-seven out of two hundred and seventy-four) correspond to the series of five to fifteen years; that is, the age of imprudence,

weakness, play and teasing. Mad dogs would generally avoid and spare children with whom they are familiar, were they not excited by the continual irritation which children inflict upon them. This fact is also explained because dogs will meet more children than other persons in the streets and lanes where they collect to play.

"7th. Another interesting fact is this, that the mortality is much less in the series where the number of bitten cases is greatest. The ninety-seven cases reported in children from five to fifteen years, proved fatal in only twenty-six cases, while in the other series the mortality has been twelve out of twenty-five, twenty-one out of thirty-four, and seventeen out of twenty-eight. Hence the conclusion that, if children are more exposed, they probably are less predisposed to contract hydrophobia, protected as they probably are by their natural freedom from anxiety, and, consequently, by perfect mental quietude.

"8th. The bites have been inflicted by dogs, principally, and chiefly by male dogs. Out of the three hundred and twenty persons bitten, two hundred and eighty-four were wounded by male dogs, twenty-six by female dogs, five by cats, and five by wolves. No bite of an herbivorous animal is reported in these documents.

"9th. With reference to the distribution of the cases throughout the year, the following facts are obtained. During the three spring months, March, April, and May, eighty-nine cases occurred; during the summer months, June, July, and August, seventy-four cases; during the autumn months, September, October, and November, sixty-four cases; and during the winter

months, December, January, and February, seventy-five cases. This leads us to conclude, then, 1. That there is no great difference between the seasons; 2. That the danger from mad dogs in the winter season is about the same as in the heat of summer; 3. That in the spring cases are most frequent, and in the autumn least frequent; 4. That the public opinion which regards winter as free from the curse of hydrophobia, and inculcates summer as causing the disease more than any other season, has no foundation in fact.

“This brings us to a conclusion of great importance, namely, that, so far as sanitary measures and the protection of the people is concerned, at all times and in all seasons we should be equally on our guard, and take efficient measures of protection against dogs. We must, however, observe that although the actual statistics furnish figures indicating an almost parallel number of cases for the seasons of extreme heat and extreme cold, it is due to the greater care in carrying out sanitary measures in summer than in winter.

“10th. Concerning the duration of the incubative stage, the statistics give results of great importance, whether viewed by themselves or in connection with previous statistics. Out of one hundred and twenty-nine cases followed by fatal results, the duration of incubation was observed one hundred and six times; and it is shown that the manifestations have been most numerous during the first sixty days, viz., seventy-three cases out of the one hundred and six. The other thirty-three cases are irregularly distributed as far as the two hundred and fortieth day, a period of eight months; but they become

gradually less and less numerous, so that after the hundredth day the cases are counted only one or two per month, and in the eighth month there was but a single case. Hence the conclusion is, that after a rabid bite the probabilities of escape increase considerably when two months have passed and no rabid manifestations have shown themselves, and that after the ninetieth day entire immunity is almost certain.

“No doubt that after this period the danger is not entirely over, and that even then bitten persons are not entirely exempted; but the prospects are more favorable, and great hope may be entertained for their recovery. It has been established from previous statistics that the duration of the incubative stage is much shorter, as the subjects afflicted with bites were more advanced in age. The results furnished lately confirm this conclusion. In comparing the periods of incubation between the ages of three and twenty, we find the average period is forty-four days; and comparing the same between the ages of twenty and seventy-two, we find the average period of incubation is seventy-five days; a marked difference, which is of great importance in prognosticating the possible consequences following rabid bites in the early period of life.

“11th. The duration of the disease was recorded in ninety cases, which show that death took place seventy-four times within the first four days, the largest number of deaths corresponding to the second or third day. Life was only prolonged beyond the fourth day in sixteen cases. Again, the statistics show that death has been the invariable termination of cases of hydrophobia,

and that the unfortunate victims have undergone the most frightful mental and physical sufferings, which explains and justifies the terror of hydrophobia, which people of all classes entertain.

"12th. The documents of the investigation furnish indications full of interest in regard to the more or less innocuousness of bites, according to the different parts of the body upon which they were inflicted. If we compare the fatal with the harmless bites made upon the same region, we find that out of thirty-two cases where the face was bitten, twenty-nine proved fatal, which gives for these wounds a mortality of ninety per cent. Out of the seventy-three cases in which the wounds were upon the hands, they have been fatal in only forty-six cases, harmless in twenty-seven, giving an average mortality of sixty-three per cent. In comparing the wounds of the arms and legs with those of the face and hands, the ratios are inverted; twenty-eight wounds upon the arms were followed by only eight fatal terminations, and twenty-four bites upon the lower limbs gave only seven fatal cases—seventeen remained harmless—showing a mortality of twenty-eight and twenty-nine per cent., and an innocuousness of seventy to seventy-one per cent. And, lastly, the ratio of mortality for wounds upon the body is shown as follows: out of nineteen bitten, twelve cases were fatal, and seven bites proved harmless.

"These facts, which are confirmatory of those afforded by other statistics, demonstrate also, that rabid wounds upon uncovered or unprotected parts, such as the face and hands, are much more readily contagious than those of the arms and legs, which the teeth of the animal can-

not reach without passing through a portion of the clothing, which wipes off the virulent moisture from the teeth. It is true, the consequences of bites upon the body seem to conflict with this statement. But we must remember that generally these wounds are more severe; that among them some are upon uncovered parts, such as the neck and chest; and that when a man is bitten by a rabid animal, and bitten upon the body, he is also bitten upon his hands, which are his natural means of defence.

“13th. The information obtained from these statistics is of great interest, concerning the means by which it is possible to prevent the effects of rabid inoculation. If we compare rabid wounds that have been cauterized with those which have not been, we find a notable difference between them. In fact, out of one hundred and thirty-four cauterized wounds, ninety-two resulted harmlessly, and forty-two fatally. That is equal to sixty-eight per cent. in the former, and thirty-one per cent. in the latter case.

“In non-cauterized wounds the result is the reverse, and more decided. Out of sixty-six wounds, the mortality is represented by fifty-six, or eighty-four per cent.; and harmless results by ten, or only fifteen per cent. Now, we must observe in relation to cauterized wounds, that it has been impossible, for lack of sufficient data, to make a distinction between them according to the degree of cauterization and the time when it took place, two conditions upon which depend the positive efficacy or complete uselessness of this means of prevention. Had these data been given, it is not too much to say that the proportion of properly cauterized wounds which re-

mained without fatal results would have been considerably higher; for the destruction by fire, of flesh smeared, and even impregnated, with virulent saliva, prevents the occurrence of rabies, we may say *certainly*, where it is done in time; that is, before the fluid deposited in the wound is absorbed."

Season of the Year.—The following tables are taken from Dr. Russell's report on hydrophobia:—

So long ago as 1780, Andry observed that January, the coldest, and August, the hottest months, furnished the least number of cases of rabies which he was able to collect; and at a later period, M. Trollet, after laborious investigation, asserted that in France the disease was most frequent among dogs in May and September, and among wolves in March and April; and that the fewest cases among dogs occurred, as Andry had stated, in the months of extreme temperature—January and August. There has already been noticed an outbreak of rabies among the dogs of Vienna in 1841, when the largest number of cases were observed in February and May, and the fewest in September, November, and December. In Algeria the disease is most prevalent among dogs in the autumn and winter. The distinguished veterinarian, Professor Bouley, in a communication to the French Academy of Sciences, April 4, 1870, gives the results of an analysis of departmental reports in France for the six years, 1863 to 1868, which exhibit for the spring, 89 cases; summer, 74; autumn, 64; and winter, 75. Professor Röhl, of the Vienna Veterinary Institute, has found the disease more prevalent in mild than in hot summers. Faber, in his Wurtemberg sta-

tistics, shows rabies to be there most frequent in March, February, June, and January, and least so in September, October, and August.

Table of Cases of Canine Rabies by Months and Seasons.

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	TOTAL.
Bourrel.....	123	109	115	123	112	120	100	114	122	105	94	102	1,339
Vienna Veterinary School.....	..	...	4	1	...	2	1	4	9	10	2	...	33
Pasta.....	6	4	6	11	16	15	18	8	9	9	7	4	113
Veterinarian.....	3	...	1	...	...	...	1	1	...	...	6	3	15
Blatchford.....	11	10	13	6	12	8	8	5	12	6	8	2	101
New York City.....	3	1	4	5	5	1	1	2	1	3	3	2	31
Total.....	146	124	143	146	145	146	129	134	153	133	120	113	1,632

	SPRING.	SUMMER.	AUTUMN.	WINTER.	TOTAL.
	M'ch, Apr., May.	June, July, August.	September, October, November.	December, January, February.	
Statistics given above.....	434	409	406	383	1,632
Paris.....	77	74	91	81	313
Lyons.....	147	121	96	96	460
Toulouse.....	16	2	11	4	33
Radcliffe	30	15	14	23	82
Total.....	704	621	608	587	2,520

CHAPTER V.

SYMPTOMS, DIAGNOSIS, PROGNOSIS.

The following excerpt from the *New York Herald*, of April 23d, 1879, presents us with an instance of the symptoms of an ordinary case of hydrophobia. It is reported by Dr. P. J. Pendergrast :—

I was first called to see Thomas Kelly, on Monday morning. I found him lying in bed. He is a young man of fine physique, and possessed of considerable muscular power. I conversed with him, and found him quite rational when I first saw him. He told me that he had been bitten by a dog in the right hand, some time in February last, and he exhibited a cauterized scar. On last Saturday he felt pains extending along his right arm to the shoulder, and a fever soon afterward set in. Growing nervous and irritable, he went to bed and sought to obtain rest. He was unable to partake of food in a solid or liquid form, and had occasional spasms. When I was called in on Monday about the same symptoms prevailed. I suspected then the true nature of the malady. He could not bear to hear even the name of water mentioned, and the running of water from the hydrant caused him to shudder and tremble. I found his pulse 120, but, though he was very feverish and excitable, his tongue dry and lips parched, he knew me, and was quite rational. After listening to his narrative of the case, I sought to disabuse his mind of any needless imagination he might have on the subject of hydrophobia, of which he then spoke coolly and collectedly. He said he had not been troubled from the bite till Saturday, nor did he let his mind dwell on the matter. When I put the thermometer into his mouth to try the temperature of his tongue he snapped it savagely, and I was obliged to apply the thermometer elsewhere. There was something about the glass that suggested water and caused a sudden spasm. In the evening, when I next saw the patient, he was suffering from spasms and a stifling and suffocating sensation in the throat. Spasms were then

occurring about every ten minutes, the teeth were firmly set and the jaws contracted. When I saw Kelly this morning he was delirious. His temperature was 102.8 degrees, and his pulse was up to 130. The spasms recurred at shorter intervals, each one being more violent than the preceding one. They extended to the muscles of the chest and legs, and he foamed from the mouth. The poor fellow, in his terrible sufferings, frequently exclaimed, "I'll bite you, I'll bite you, if you come near me!" The least draught or current of air would produce a spasm, and even the sudden raising of the bed-clothes and letting them fall again would cause the same difficulty. After each spasm he is, of course, greatly prostrated. With the exception of two spoonfuls of brandy and milk, which he swallowed on Monday with great difficulty, he has not partaken of any food since Saturday.

Virchow* has divided the symptoms into several distinct stages. In the first stage there are feelings of *malaise*, uneasiness, restlessness, loss of appetite, stiffness around the neck and throat, pyrexia, nausea, vomiting, headache and excitement. But these symptoms are not always present, for the patient often suddenly develops the difficulty of swallowing liquids, so characteristic of the disease. The local symptoms are sometimes present, sometimes absent. There may be irritation of the cicatrix in the neighborhood of the bite, accompanied by shooting pains of the character of chronic rheumatism; this symptom being one of the most persistent. The cicatrix may become red, swollen or inflamed, and, if unhealed, may assume an unhealthy appearance, discharging a thin, ichorous fluid. The *morale* is changed, patients become depressed, lonely, quieter, and listless; some are anxious about the bite, others endeavor to dis-

* Dr. Dolan. Op. cit.

miss it from their memory. Many are usually irritable and ill tempered.

As Poland remarks, there often ensues a characteristic anxiety, attended with pain in the præcordia, and sense of weight and pressure on the chest. There is disturbed and broken sleep, the patient suddenly starting up in frightful dreams; often sinking back into mental depression, and becoming apprehensive and gloomy. The generative organs are sometimes excited, inducing priapism and seminal ejections. There is loss of appetite, no desire for swallowing, a feeling of clamminess, sighing, and oppression of breathing, with unusually deep inspirations. The voice is rough; there is a sense of languor and lassitude; great weakness and heaviness; sometimes slight convulsive twitching about the face and extremities; the heart's action is strong. This description is based upon Poland, Tanner, Fleming, and some of the older writers, besides the descriptions afforded by individual authors who have had practical experience of the disease. In fact, one description is the copy of another. According to Fleming, the urine, at first limpid, becomes red, sanguinolent, and flows in a small quantity after the paroxysms. It contains renal epithelium and much albumen.

The researches of M. Gubler at the Beaujon Hospital, France, show that in hydrophobia the urine is acid; nitric acid added to it develops a thick coagulum of albumen, and determines the formation of a diaphragm of uric acid, mucus, and an abundance of earthy phosphates, and carbonates. Heated in a tube, and cleared by filtration of the albuminous precipitate, the urine of hydro-

phobic patients, when submitted successively to the action of caustic potassa and the cupra-potassic fluid, gives reactions which indicate the presence of a notable quantity of sugar. The presence of this sugar would appear to be mainly due to the congestion of the brain and spinal cord, as well as the kidneys, according to some authorities.

Bazin says that if the albuminuria and glycosuria were noted at a stage of the disease when asphyxia had not yet commenced, or during the period of incubation, they would be of importance as symptoms; they would demonstrate, in fact, that before the outbreak of the malady grave alterations, due to the passage into the blood of some virulent matter, are taking place. The temperature is increased from the commencement of the disease, and rises as high as 105° or 106° (Fahr.) in the later stages. In one of the Nottingham cases, recorded in the *British Medical Journal* for December 2d, 1871, five *post-mortem* thermometrical observations were made (per rectum), which proved, beyond a doubt, the intensity of the chemical change taking place in the body, at least during the last period of the malady. The temperatures were as follows: At 11.30 A.M., 106.2° ; at 12.45 P.M., 103.4° ; at 1.45, 101.2° ; at 2.45, 98.4° ; at 3.45, 91.2° .

The second or actually specific stage is that of irritation, dread of drink being its chief character. It generally follows after the premonitory stage, but in some cases it may become developed at once, so rapid and sudden as to take place without any preliminary manifestations. It is ushered in with stiffness of the muscles

of the throat, jaw, and root of the tongue, pains in the epigastrium and diaphragm, chilliness and drowsiness. Next, there is hyperæsthesia of the eighth pair of cerebral nerves, as evinced by the convulsive spasms of the muscles of deglutition, rendering every attempt at swallowing difficult and causing severe paroxysms. Hence the great dread of solids and fluids, and the subsequent dryness of the mouth and throat, with distressing, burning thirst, which cannot be quenched; the spasms extend to the muscles of the larynx, inducing hurried respiration, and a sense of suffocation; the voice is changed and hoarse; the secretion of the mouth and fauces, which were at first frothy, become now viscid, and can only be expelled with difficulty, causing a hawking and barking noise in the effort; the convulsive spasm afterward involves the muscles of the general system, through the spinal and cerebral nerves, inducing convulsions which may resemble tetanus and epilepsy. The thirst recalls the lines of Celsus (Lib. v, cap. 27): "*Miserrimum genus morbi; in quo simul eger et aquæ metu cruciatur; quo oppressis in angusto spes est.*"

There are flatulency and vomiting of a dark-greenish bilious fluid; the micturition is frequent, and in later stages the urine is passed involuntarily; the senses are rendered morbidly acute, the surface of the body irritable and readily acted upon by the slightest gust of air, even the feeling of the pulse inducing an accession of the convulsive paroxysms; the sight or sound of fluids cannot be borne, as aggravating the attacks; sometimes even the smell of particular things will do so. The mind becomes in a frightful state of anxiety and alarm;

there is a fear of even their best friends, and of being left alone; there is no comfort or consolation, but indescribable despair, and sometimes entire loss of control, exciting rage. Cœlius Aurelianus noted this hyperæsthesia, and cautioned practitioners when bleeding such patients to prevent the sound of the blood being heard by them—*ne sonitu percussi commoveantur*. Trousseau mentions a case of exalted sensibility of the nerves of scent. There is no sleep, and the patient is often talkative and verbose. The mental disturbance may be very slight, but on the other hand, attended with temporary rabid impulses and delusions, sometimes causing an inclination to bite. The features present a wild, sparkling appearance; the brows contracted, the eyes staring, the angles of the mouth contracted, and an intensely haggard and anxious aspect. As the disease progresses, the paroxysms increase both in frequency and violence, and are oftentimes attended with great cerebral excitement, bordering upon wild, maniacal fury; the duration of this stage may last from twenty-four to forty-eight hours; it is generally short and severe. In rare instances the patient gives way to wild fury, he roars, howls, curses, strikes at the persons near him, and breaks or tears anything within his reach, after which exhaustion follows, from which he is aroused by another paroxysm. The third or paralytic stage is the decline and last moments of the disease. It is attended with rapid depression and nervous exhaustion, intermission of the paroxysms, incoherency and delirium; there is great emaciation; the mouth remains open, and the saliva runs out, or else passes back into the throat, causing a gurgling noise, and

the urgent attempt to swallow or spit it out induces a choking sensation (Poland). The vehemence with which the patient spits out, in the earlier stages of the case, is, to a bystander, one of the most striking phenomena, though toward the end the jaw appears sometimes partially paralyzed (Fleming).

The pulse becomes small, quick, and irregular, the skin bedewed with clammy sweat, the eyes dull and sunken, and the pupils large, and death takes place, either from asphyxia during one of the convulsive attacks, or from exhaustion. The patient, however, may die quietly, sinking into a state of repose, with abatement of all the symptoms; in one case being able to eat and drink, and expiring immediately on suddenly waking. The duration of the disease throughout its whole course varies from seventy-four hours to six or seven days; death generally occurs on the second, third, or fourth day. It has been fatal in sixteen hours.

As has been previously pointed out, hydrophobia may or may not be a symptom of the disease. This fact was alluded to by the earliest writers, Eudemus, Soranus, and Coelius Aurelianus; and Berkenhout, writing in 1783, says: "I am even inclined to assert that the hydrophobia is not generally a symptom of the disease produced by the bite of a mad dog. It rarely happens that the patient has any aversion to water or other liquid, until by experience he finds an insuperable difficulty in swallowing. He then dreads the approach of water, having already found that the attempts to swallow any liquid produce a violent and painful convulsion, so that the symptom in question is rather a real

difficulty in swallowing liquids than any dread of water. As far as my own experience reaches, I can with great truth aver that I have never yet met with a single patient who expressed any aversion to the sight, sound, or mention of water, until he had found by experience that drinking gave him pain."

Jesse Foote, in 1788, also says: "Dr. Mead hath remarked, and with strict propriety, in my opinion, that the word does not convey the true meaning of the effect of water upon the patient, when the frightful symptom is upon him, which is not a dread of water, but despair of gratifying thirst, through the impossibility of swallowing it." The symptoms vary with the peculiar idiosyncracies of the patient, and hence no detailed account of them may be given which shall apply with truth to every case. Referring again to Dr. Dolan, we find "that there exist but two periods in this disease; first, that of incubation; and, second, the period of development, including all the phenomena occurring, and time elapsing between the first symptom and death."

The misnomer—hydrophobia—is made apparent from an analysis of over two thousand cases, in which there was not one instance of "dread of water." The patients ask for it, but are prevented from swallowing by muscular spasms, these being entirely due to an exalted reflex excitability acting upon a diseased mental condition in which consciousness is retained, but the will so degenerate as to be unable to control the external manifestation of the appetite in such wise as desire commands. Herein lies a difference between the rabies of lower animals and the hydrophobia of man. The former drink with

avidity. Sauvages writes: "Constat repetita apud Gallos provinciales experiëntiâ, canes luposque rabidos bibisse, manducasse, flumen transisse, ut olim Marologii et bis Forolivii observatum, adeoque nec cibum nec potum aversari."

Among many valuable papers sent me by the United States Consul-General, at Berlin, for whose courtesy I am under great obligations, the following will be read with interest. It is translated from the *Mittheilungen aus der thierärztlichen Praxis*, 1867:—

RABIES IN THE DOG, AND HYDROPHOBIA IN WOMAN.

BY BLOCK,

Veterinary Surgeon in New Brandenburg.

On the 18th of July, 1866, the wife of a shoemaker, Pr., living here, brought her pet dog to me, with the following history: "The dog is sick, scrapes himself, tears his hair out with his teeth, and, on account of this behavior, I believe him to be mad." These symptoms I found to be true, and also observed reddish pustules scattered over his body; they were red spots of a small size, which caused much painful itching, as the dog often bit himself quite suddenly, and with seeming satisfaction and relief. At such times his hair flew about in little bunches. The warmth of his skin increased. His consciousness was not at once interfered with, as he would get a stone that had been thrown away, with accuracy, and would punctually obey the calls of his mistress. I declared this disease to be of a typhoid nature, and prescribed glauber salts with extract of gentian and henbane, and externally a medicament for drying the skin. The next morning the woman said that the dog had been very turbulent during the night, that he coughed, and that slime appeared on his mouth, that he had red eyes, etc. At my call I found, also, an unsteady "eye-look." His voice was peculiar. I heard it after the dog had been carried into the room in the arms of its mistress. He then ran into the bedroom, jumped upon the bed, and crawled under the covers, where he howled in the same voice as I have heard in mad dogs. This barking is as though the

dog was in a half unconscious state. I ordered the dog to be tied, after which I asked the veterinary surgeons, C. and Z., to look at the dog; they were not at home; and a like request to the head physician was answered with the advice to use a muzzle or to tie the dog. Finally, I went to Dr. W., who came with me to see the dog, who, as their family physician, told the proprietress to observe my orders. Meantime, the veterinary surgeon, Z., had been there, and had quieted the family by assuring them that the dog was not mad, and had ordered castor oil, which the dog had taken. Upon my return I was received coldly, and was told that my medicine had increased the illness. The next day the dog died. I was not informed of the fact, but subsequently I was told that the dog had swallowed a bone, which pierced his bowels, and he died in consequence. The dog had been ill a week, during which time he had paroxysms of periodical restlessness, slime in the mouth, red eyes, tearing out of his hair and vomiting, and at intervals he was free from all trouble.

On the 10th of August the niece of Mrs. Pr., a young lady, twenty-four years old, died of hydrophobia. According to the report of Dr. W., she had given the dog medicine, and, in addition, had interested herself very much for him, he being her pet dog, and, in consequence, was undoubtedly infected by him.

The few symptoms observed gain strength and importance when I add that I have seen several cases of typhoid inflammation in dogs this year, which I have cured; that it is epizootic among them, and that this case was such a one, grown into rabies.

This is confirmatory of the experience of Dr. Jurnitschek, who writes in his pamphlet, *Hundefrage*, 1864, page 37: "Lately the resemblance of these fits (hydrophobia) to those of typhoid fever has been more and more marked, so much so that some would make the disease identical. A comparison might be made with the 'influenza' of horses, which, if it assumes a typhoidal type, easily merges into glanders, as was the case with the horses of the Princess of Neustrelitz, in 1840-43, or with the plague in England, Belgium, etc., which is considered by many to be a lung disease of a high grade, or with the pig disease in Wulkenzin, Neuendorf and Weiten, which turned into a worse form—hypochondriasis—when, by breathing the foul air, I myself caught the disease. I consider hydrophobia a disease of the blood, and not one of the nerves;

otherwise, how explain the pustules, scratching, etc., except upon a theory of congestion tending especially to the mucous membrane, together with the slime of the mouth, paroxysms, and the production of the contagion." * * * *

Diagnosis.—"The symptoms are so characteristic that they should not be confounded with any other disease" (Dr. Dolan). From tetanus, Drs. Holland and Shinkwin point out the following differences:—

1. Tetanus results from injuries of the most varied character.

2. The effects follow in a very short space of time; a week seldom, if ever, elapsing between the injury and the development of the symptoms; while the shortest interval between the bite and the first symptoms of rabies was 12 days, the longest 334 days, and the average 61 days 18 hours in the 120 cases collected by Dr. Holland.

3. That anxiety, horror, dyspnœa, or convulsions at the sight of fluids, form no part of the symptoms included under the term tetanus.

4. That in tetanus some of the muscles are often in a state of rigidity, and the convulsions occur at much shorter intervals than in cases of rabies.

5. That delirium is a very rare symptom in tetanus, and a frequent one in rabies, occurring 80 times in 120 cases.

6. That in tetanus the secretion of saliva is seldom increased.

7. That in tetanus the muscles of the lower jaw are frequently in a state of continued tension.

8. Opisthotonos, or emprosthotonos, often terminates the case.

9. As Fleming remarks, physiologically, while tetanus is a disease of the true spinal system of nerves, rabies involves the brain also, as evinced by the disorder of intellectual function, and special sense, even early in the disease.

From œsophagitis Holland points out these essential differences:—

IN ŒSOPHAGITIS.

1. Pain in the pharynx, throat, or along the spine, occurs as the earliest and invariable symptom.

2. The attempt at swallowing solid food causes intense pain, and in aggravated cases swallowing of even fluids is accompanied by pain, or may be totally impossible.

3. Horror of fluids reported to have occurred in one case.

4. The amount of difficulty in swallowing is in direct proportion to the extent and intensity of the pathological appearances found in the œsophagus.

5. Saliva abundantly secreted, expectoration difficult, and the time of the occurrence of these phenomena is not fixed.

6. Urgent thirst in perhaps all cases.

7. Average duration of the disease seven days.

8. Generally terminating in recovery.

9. Death caused by œdema of the glottis, gangrene, or rupture of the œsophagus.

IN RABIES.

1. Pain in the pharynx, throat, and along the spine, occurred in 42 out of 120 cases, or about once in every three cases, and not as the earliest symptom.

2. The attempts to swallow fluids, though not generally accompanied by intense pain, causes dyspnoea, convulsions, etc., while solids can be in most cases taken with comparative facility.

3. Horror of fluids the most prominent symptom in 119 out of 120 cases.

4. No direct relation exists between the pathological state of the œsophagus shown after death and the intensity of the dysphagia.

5. Saliva secreted in great quantity, often flowing spontaneously from the mouth, and these symptoms often occurring among the last phenomena.

6. Thirst was urgent in about one-third of the cases.

7. Average duration of the disease seven days.

8. Invariably terminating fatally.

9. Death most probably resulting from asphyxia, coma, or relapse.

Fleming, page 265, *op. cit.*, says: "Indeed, it is not

possible to mistake hydrophobia for any other malady, or to doubt its existence when it is present; for if, during the stage of incubation, doubts and fears may exist, all uncertainty comes to an end when the disease really appears. The muscular debility complained of in many cases, the restless sleep out of which the patient starts up, his continual fidgetiness, his suspicious breathing, his sadness and search after pleasure, and then his love of solitude, must awaken terrible fears in the physician, especially if there be no moral causes or organic lesions to satisfactorily account for these symptoms. The intense thirst, and general muscular pains and rigors, which might at first be ascribed to some grave febrile affection, all followed by a symptom that is almost pathognomonic of hydrophobia, namely, a sudden difficulty in swallowing liquids, water in particular, when there is complete inability to drink, and when this dysphagia is immediately succeeded by tremor on the patient carrying some liquid to his lips, all illusion is dispelled and it becomes clear that he is under the fatal influence of rabies."

Prognosis.—Hydrophobia must always be regarded as one of the gravest of all maladies to which humanity is subject. Dr. Hammond, *Diseases of the Nervous System*, p. 654, says: "But, although the prognosis is so hopeless in the developed disease, it is much more favorable as regards the probability of the supervention of hydrophobia from the bites of rabid animals, for, of those bitten by dogs unmistakably affected with the disease, not more than one in fifteen becomes successfully inoculated. This liability differs greatly, according to the circumstances of the part being covered or not. The

wounds of the face, neck, or hands, are much more likely to be followed by hydrophobia than those inflicted on the legs or feet, when the virus is rubbed off by the clothing before the teeth reach the flesh. The bite of a rabid wolf is more apt to be followed by the disease than the bite of a dog, for the reason that the first named generally seizes the throat or face. Thus, Trollet states that at Brives, in France, seventeen persons were bitten by a rabid wolf, of whom ten died of hydrophobia; and of twenty-three bitten by another, thirteen died.

On the other hand, Hunter states that on one occasion a dog bit twenty persons, of whom only one was inoculated. Those first bitten by a rabid animal are more liable to have hydrophobia than those bitten subsequently, when the poison is, in a measure, exhausted. Probably the most dangerous wounds are those which barely penetrate the epidermis, and in which, therefore, the venom is not washed away by any flow of blood." While Dr. Hammond asserts that we have no well-authenticated instance on record of a cure of a case of hydrophobia, Dr. Dolan, p. 163, writes: "Can we only endorse the opinion that death is the physician that cures, *ἰατρος ἰατρὶ θάνατος*, and we can only promote the patient's euthanasia, in a manner certainly more scientific and more humane than the smothering practices of our ancestors; that our only resort is to poison the patient, *cito tuto et jucunde*, by chloroform, or chloral hydrate? We must emphatically assert, cases of recovery have been recorded, and have taken place; that the evidence on this point is as conclusive as the evidence that such a disease as rabies exists; and to deny the existence of such

records of recovery, is simply to deny the existence of the disease. We can only know rabies by the symptoms and by the description we have furnished by those who have had cases under treatment.

If the evidence is satisfactory and conclusive that rabies has existed, and, unfortunately, been too fatal, it is also equally satisfactory and conclusive that Dr. Offenberg has described the disease, and attended a patient who recovered, and that Dr. Austin Flint has offered similar testimony.

We are not enthusiastic on the subject of the efficacy of *curara*; but we feel it our duty, with the utmost deference, to enter a protest against statements which are not verified by fact, and which strike at the root of medical progress and medical science. The injurious tendency of such teaching we have already had occasion to animadvert on, and we have attributed much of our ignorance on the subject of this disease to the influence exercised by some of the older physicians. * * *

We cannot admit the impossibility of discovering a remedy, and we are not disposed to write over the door of a patient's room the despairing and well-known lines of Dante:—

“Lasciate ogni speranza.”

The treatment in the past has been, in the majority of cases, irrational and unscientific; the majority of the deaths may be attributed as much to the bad treatment and the action of the medicine administered as to the virus introduced into the system. Encouraged by the recoveries that have taken place, we venture to prophesy

future successes, if not with *curara*, still with some other remedy wrested by the skill of the scientist from the grand laboratory of Nature. We believe that there is not a poison in existence for which there is not an antidote. We have faith in our profession; a faith not resting on the changing quicksands of medical theories or opinions, but built on the sterling triumphs of medicine over diseases which were pronounced by our ancestors incurable. We cannot recognize, then, in rabies, any special conditions which preclude us from hoping that the beneficence of the Creator, which enables us to grapple with other diseases, will grant us similar power over this sad scourge of humanity."

The experiments made with *oxygen* by two Russian physicians, Drs. Schmidt and Zebeden, with a well-authenticated cure of a case of hydrophobia from its administration, reported in the *Lyon Médical*, inspire the hope that at last science has struck the physiological keynote; and that, in well-established instances of the disease, the physician may look with a reasonable assurance to a successful termination. Modern inquiry has stripped away the shroud of gloom that, from earliest time, has enveloped the disease. The superstition that was bred of ignorance is routed by the advance of intellect. If hydrophobia be primarily due to a blood ferment acting upon the red corpuscles, then we may expect the most satisfactory results from the use of *oxygen*.

CHAPTER VI.

TREATMENT—PRESERVATIVE, CURATIVE, PREVENTIVE.

Preservative.—We will now pass at once to a consideration of the means of preservation and cure which are at present exciting discussion, and upon which the best practice of the day is based.

Suction.—Bouley, p: 47, thus expresses himself in regard to suction: “The first means which may be preventive, if applied without a moment’s hesitation, is the prompt suction of the wound. This the bitten person, in many cases, may apply at once himself, when the wound is convenient for him to reach with his mouth. The blood which flows under the influence of the sucking of the lips, brings away with it the virus which may have penetrated within the capillaries of the wounded parts. The chances of the absorption of this liquid, if not destroyed, are at least considerably reduced. No doubt it may be said, as an objection, that if in this practice the virus is not absorbed through the wound, it may be through the mouth, the mucous membrane of which is so delicate. But this danger may be avoided, if, after each application of the mouth to the wound, the liquid is immediately rejected. Under any circumstances, it seems that in such a case there should be no hesitation on the part of the sufferer in considering what he has to do, for most certainly the chances of absorption of the virus are greater through the surface of a flesh wound than through that of a healthy mucous

membrane; but if, under the specified conditions, the chances of absorption of the virus through the surface are small, I would not dare to say that they are entirely negative; neither can I recommend suction as a general practice in the case of persons not in danger. I can only recommend it as a means always at hand, and ready to be applied when any other cannot be had, and as one which might prevent the terrific danger to which bitten persons are exposed; yet I fear the responsibility of the results to those who, urged by affection, might have recourse to its employment for the benefit of one near and dear to them."

In the time of Cleopatra suction was resorted to as a remedy against the venom of an asp. In England, in the thirteenth century, historians tell us that Eleanor sucked the wound of King Edward I, which had been caused by a poisoned dart. The ancient writers, from the time of Dioscorides, all allude to it, and Berkenhout, in his essay, already alluded to, revived the idea. The practice has, in these modern days, met with opposition, and Sir Thomas Watson, in the *Nineteenth Century*, December, 1877, confesses his disapproval of it, lest the helping neighbor rush into the very peril he was desirous of averting. Lipscomb also condemns the practice, though the poetic fancy may be tickled by the romance. Concerning this needless fear, Fleming says: "It may be objected to this practice (suction), however, that the absorption that does not take place by the wound may occur by the mouth, if there chance to be any abrasion in that cavity or on the lips. But this risk may be largely averted if care is taken to spit freely

after each aspiration. At any rate, though such an accident is possible, yet it is so unlikely, that the wounded person should have no hesitation whatever in at once adopting this means; for assuredly the chances of absorption of the poison in this way are infinitely smaller than they are if it is left in contact with the fresh wound."

Dr. Dolan is much more energetic: "We are diametrically opposed to this point, and must unhesitatingly recommend it. We agree with Fleming (*Veterinary Journal*, p. 16, 1878), that suction for the removal of poisons from wounds has been practiced from time immemorial, and yet there is no evidence whatever to prove that it has been a fatal practice. On the contrary, not only has the operator, in every recorded instance, escaped danger, but the operation itself appears to have, in many cases, preserved the life of the wounded individual. The poison is not retained in the mouth, but is immediately and forcibly expelled, so that if there be any danger of absorption by the mouth, or by an abrasion, the chances of infection are infinitesimally small. Even though the risk was greater than it is, it should not deter the bystander from attempting a noble and devoted act. * * * * Suction, then, should be energetically and speedily employed, either by the bitten individual or the bystander, care being taken to spit freely after each application of the mouth, and subsequently the mouth may be rinsed out with some fluid, as water, milk, vinegar, or beer, or spirits, which are generally attainable, even though water may be scarce. It must ever be remembered, as Fleming says, that time

is a most important element, and waiting for caustics, cupping glasses, or the surgeon's scalpel, may be synonymous with waiting for death."

EXPRESSION, WASHING, COMPRESSION AND CUPPING.

Squeezing or expression of the wound should always be resorted to, in conjunction with suction, in order to increase bleeding. Washing the wound with cold water, or, as Bouley suggests, with chlorinate of soda, is a wise measure. Fleming refers to an instance where several persons escaped inoculation after being bitten by a rabid bear, by being compelled to swim a river. A handkerchief, bandage or leather strap may be applied between the bitten part and the body, to prevent the virus from entering the general circulation. It is a useful adjunct to suction, cupping, etc. Cupping is so simple that any one may practice it. In lieu of a more suitable apparatus, an empty bottle, from which the air has been exhausted, may be applied over the wound, and bleeding established, by incisions made with an ordinary pocket knife.

Cauterization.—Having resorted to one or the other of the foregoing plans, we should have recourse to cauterization as soon as possible. An objection has been raised against the hot iron, that the eschar formed on the surface or upper part of the wound might shut in some portion of the virus, but the physician will modify his treatment according to circumstances.

Bouley says:—

"From the documents already mentioned, it is proved that the cauterization of the wounds with red-hot iron, made with the great-

est thoroughness, and in the shortest possible time after the inoculation, has proved the most certain prevention.

“I cannot say, and I fear it would be temerity to attempt to indicate, within what limit of time the absorption of virulent saliva takes place when brought in contact with a wound by a bite, or otherwise. The results of experiments in this direction are not as yet sufficient to enable us to decide understandingly. But what can be said without fear of mistake is, that cauterization cannot be applied to an existing wound too soon, that the red-hot iron is preferable to all other means, and that it is better to apply it in excess than in a timorous way.

“This operation does not require, positively speaking, the services of a surgeon, at least not when the wounds are superficial, or when, having penetrated only to a moderate depth, they are altogether in the flesh.

“It is easy to improvise instruments which may be used for this purpose: an iron bar, a fluting-iron, a poker, any rod of iron, in fact, even the blade of a knife, or those of a pair of scissors, all may answer the purpose; but it is preferable if the object is round rather than flat, for it holds and retains the heat better. In using it, the iron must be heated to a *white heat*, and when applied to the wound it is to be held there with a firm and steady hand, carefully turning it through the whole length and to the full depth of the wound, for absolute certainty. The cauterization being done once, it is well to repeat it a second time.

“The intensity of the pain is here of secondary consideration; no matter how intense the sufferings of the moment may be, when we consider the importance of the object at stake. Indeed, people generally have a greater dread of the pain thus caused than there is any occasion for. This pain is entirely endurable, especially when the parts in immediate contact with the cautery are carbonized. It seems, indeed, if I can credit the report made to me by M. Leblanc, of Paris, who spoke from personal experience, that cauterization of a rabid wound would be, I will not say pleasant, but not without a certain satisfaction, resulting from the idea of the good that it will secure, and the relief to the mind. When a cautery is needed, and the hot iron cannot be obtained immediately, one may cauterize the wounded parts by using gunpowder, as appears from information received by the Academy of Medicine through a

M. Maniere, who for fifteen years lived in Hayti. Rabies is a frequent disease in that climate, and is observed in all seasons, but it is not followed by fatal results in proportion to the number of bites, because every one there appears to know the way to prevent it. As soon as a wound is received it is filled with gunpowder; this is ignited, and thus a very efficacious cauterization is instantly produced, which can be applied at once, the powder being easily obtained."

The thermo-cautery of Paquelin may be used with great advantage.

Caustics.—Nearly all the caustics of which we have knowledge have been more or less lauded. The strong fluid acids, such as acetic, nitric, hydrochloric, and carbolic acid, and such escharotics as nitrate of silver, perchloride of iron, muriate of antimony, and corrosive sublimate have all been employed. Dr. Geo. B. Shattuck, in the *Boston Medical and Surgical Journal*, February 7th, 1878, thinks that "the lunar caustic would be found more useful than the hot iron, in unpracticed hands, and in many wounds." Lafosse states that the cautery should not be preferred to the exclusion of caustics, except in cases in which the wounds are deep, or in regions such as those of the mouth or nose, where solid or fluid caustics might prove dangerous. It is also well to note that Constantinescu (Fleming) states that the nitrate of silver, alcohol and ammonia, applied to wounds some moments even after they were inflicted, have not prevented the development of hydrophobia. Of the solid caustics, Blaine and Youatt prefer the nitrate of silver. It should be applied thoroughly, immediately after receiving the wound. The "potassa fusa" is, however, more prompt and more destructive in its action.

Sometimes it may be necessary to enlarge the wound and insert probes dipped in melted caustic potash; or we may use the nitrate of antimony, of which Sabatier speaks very highly. Lint soaked in iodine has had its advocates. The caustic potash, thoroughly applied, is, beyond question, the most efficacious remedy that we have after the actual cautery.

Excision.—Great care should be taken, in the excision of wounds of this nature, that the blade of the knife be not instrumental in the diffusion of the virus, and that every particle of contaminated flesh be excised. Fleming advises two incisions, one on each side of the wound, forming an ellipse. Mr. Abernethy recommended the following plan: the cell into which a penetrating tooth has gone must be cut out. Let a skewer be shaped, as nearly as may be, into the form of the tooth; and then be placed in the cavity formed by the tooth; and next let the skewer and the whole cell containing it be removed together, by an elliptical incision. If excision be rendered dangerous from the proximity of the wound to blood vessels, nerves, or tendons, we must resort to caustics. Jesse Foote (op. cit.) believed that excision of the bitten part was the only sure method of prevention. He illustrates his opinion by several cases, and gives the following list of the time when excision was performed in his cases:—

Case I. After 32 to 35 hours.

Case II. After 68 hours.

Case III. After 12 hours.

Case IV. At once.

Case V. After 72 hours.

Case VI. After 20 hours.

Case VII. After 6 hours.

Case VIII. At once.

Results of Cauterization.—I am indebted to Fleming for the following particulars: We have but little means of ascertaining to what extent cauterization of the wounds inflicted by rabid animals has been really successful, in a large number of instances, our experience in this country being limited to individuals, here and there, whose cases have chanced to be reported. But M. Bouley, impressed with the great interest that belongs to this question, has endeavored to make the most of the statistics available to him, and has given the result, in the following terms (quoted in Chapter IV), of 115 cases of hydrophobia terminating in death, in France. Tardieu has tabulated them as follows:—

Years.	Died of Hydrophobia.	Not Caut'd	Tardy Cauter'n.	Insufficient Cauter'n.
1852, '53, '54,	44	26	18	0
1855,	21	11	5	5
1856,	20	11	6	3
1857,	13	10	3	0
1858,	17	6	5	6
	<hr/> 115	<hr/> 64	<hr/> 37	<hr/> 14

In Algeria, out of the 16 cases of immunity already referred to, 14 had the wounds inflicted by rabid animals cauterized more or less promptly; in two instances three persons were cauterized twenty-four hours after being wounded, and a fourth in thirty-six hours. The following table gives the details of the 16 cases:—

Immunity after immediate cauterization with hot iron	7
“ “ “ gunpowder	1
Immunity after late appearance, cauterized with hot iron	1
Immunity after at least 24 hours	3
“ “ 36 hours	1
“ “ immediate cauterization with muriate of antimony after 3 hours....	1
Immunity without adopting precautions.....	2

Thus it will be seen that one-half the cases of immunity might be supposed to be due to immediate cauterization, three-eighths to tardy cauterization, and one-eighth escaped without any treatment.

Of the 47 deaths tabulated by Roucher as occurring in Algeria, we find that their relations with preventive or preservative measures are as follows:—

Died without wounds having been cauterized	25
“ “ indications of precautions.....	10
“ after tardy and incomplete cauterization with hot iron.....	2
“ “ cauterization with hot iron.....	5
“ “ “ “ nitrate of silver.	1
“ “ immediate cauterization with ammonia, supplemented by the hot iron, and an hour and a half subsequently.....	1
“ “ immediate cauterization with ammonia...	2
“ “ “ “ “ hot iron....	1

In the 47 deaths only one occurred after immediate cauterization with the hot iron; 12 were preceded by delayed or insufficient cauterization; and 35 had not been submitted to any preventive treatment; for it is very probable that in the 10 cases which afford no indication of precautions having been adopted, none were

resorted to ; so that of the 37 cases allowed to take their natural course, there were 2 of immunity and 35 deaths, or a mortality of 94.6 per cent. Of the 9 in which cauterization with the hot iron was immediately employed, there was only one fatal case, or a mortality of 11 per cent.; and of the 16 cauterized after some days, or in a manner more or less imperfect, there were 10 deaths, or a mortality of 62.5 per cent. Among the fatal cases whose history was more or less known, there was only one in which the wound had been at once treated with the actual cautery, and another in which ammonia was applied first and the hot iron some time afterward. In three instances there was a delay of nine and twelve hours, and in other three of some hours. In three more of the 47 cases cauterization was incompletely effected by ammonia or nitrate of silver; in one case cauterization was only resorted to after two days; and twice the wounds were dressed immediately with liquid ammonia. The only patient who died after having his wounds immediately cauterized with the hot iron was believed to have been saved, as he enjoyed excellent health for six and a half months, and in that time had taken part in the expedition against the Kabyles, in 1851, and returned quite well. In the two which had the wounds dressed immediately with liquid ammonia, the period of incubation extended to 116 and 130 days; a circumstance which might give rise to the supposition that caustics have a retarding influence in the development of the disease. Three persons mentioned by Toussaint, of Algeria, who had been bitten and had their wounds cauterized—two immediately, and one the next

day—escaped the consequences ; while a fourth person, who did not have his wounds attended to, died of hydrophobia. Hugo speaks of seven persons who were bitten by a rabid dog ; three had their injuries cauterized twenty-four hours afterward, and the other four cauterized themselves with two pieces of iron heated in the fire ; all escaped. The same dog attacked a child twelve years old, and its wounds not being attended to, it died of hydrophobia. Youatt, who trusted to caustics, and who had himself been bitten seven times, says that he had used caustics for the wounds of more than four hundred persons who were bitten by dogs, of whose disease there could be no doubt, and that not one of these became affected ; and a surgeon of St. George's Hospital told him that ten times that number had undergone the operation of excision there, after having been bitten by rabid or suspected dogs, and it was not known that any of these persons had become diseased.

CHAPTER VII.

TREATMENT CONTINUED—CURATIVE.

Leaving for future consideration the various medicaments which have been resorted to in the treatment of hydrophobia, I shall confine myself in this chapter to such remedies as have, of late, excited very general interest, and from the administration of which we may look for the happiest results. In this connection, it will be well to mention, also, the general treatment, mental and physical, which are valuable accessories in restoring a just economy between cerebral and bodily function. The remedies upon which the practitioner must base his treatment are curara, oxygen, and Turkish baths. Calomel, sulphate of soda, magnesia, carbolic acid, atropia, bromide of potassium, chloral hydrate, chloroform, etc., have all been used, sparingly and heroically, and they have all proved signally unsuccessful. For in those instances in which cases of cure of hydrophobia have been reported as due to the administration of calomel, I am led to infer that they were *post hoc* and not *propter hoc*, while others are not sufficiently well authenticated to be trusted. I am not an enthusiast in regard to curara; neither am I disposed to pin my faith to oxygen, because, in advocating the exclusive use of either, or both, disregarding entirely the effects which have been obtained from other remedies, be their results ever so unsatisfactory, I can see how much danger would result to the profession. The number of cases treated by

oxygen is so very small, that it would be presumptuous to draw any absolute conclusions in relation to it. Moreover, when we consider that during the civil war in the United States, what enthusiasm surrounded oxygen in the treatment of typhoid fever, and how this enthusiasm as suddenly died out, not a single case having been benefited by it, it would be premature and irrational to pronounce definitely upon its usage.

Curara.—The following literature upon the subject of curara, is of interest:—

Geheilte Hundswuth beim Menschen—Ein Beitrag Zur Kenntniss des Curare, von Dr. Ad. Offenbergh, Praktische Arzt in Wickrath (Rheinpreussen) Bonn, 1879. Wegen der Einzelheiten über die Wirkungsweise des curare möge man die neueren Handbücher, z. B. Nothnagel u. Rossbach Arzneimittellehre, 1878, pp. 691–696; oder L. Hermann Toxicologie, 1874, pp. 299–310, nachschlagen. Sitzungsberichte der Niederrheinischen Gesellschaft für Natur- u. Heilkunde in Bonn, Sitzung vom 17 Mai, 1867. Nothnagel, Arzneimittellehre, ii, Aufl.; 1874, p. 86. Eulenberg, die hypod. Inj. d. Arzneimittel, 1875, p. 232. Nouveaux Médicaments, 1865, p. 539. Formulaires des Médicaments nouveaux, p. 470. F. v. Niemeyer, Lehrbuch d. spec. Path. u. Ther. 8 Aufl., 1869. Nach. Eulenberg Hypod. Inj. d. Arzneimittel, p. 230. Bollinger “Die Wuthkrankheit” in Bd. iii—des Handbuchs der spec. Path. u. Therapie, von v. Ziemssen, 1874, p. 571. Eulenberg, Lehrb. d. Nervenkrankheiten 11. Aufl. Th., p. 602, 1878. Die Pharmacopœia Helvetica Supplementum, p. 142. Binz. Grundzüge d. Arzneimittellehre 11, Aufl. p. 18. Eulenberg, Preuss. Medicinal-Kalender, 1879, p. 52. Beigel, Die hypod. Inj. d. Arzneimittel, iii Aufl., p. 222. Preyer, Verhandlungen des naturhistorischen Vereins der Preuss. Rheinlande u. Westfalens, 24 Jahrgang, p. 71. Der Preuss. Med. Kalender, 1878 u. 1879, p. 12. Dr. Steiner, das Amerikanische Pfeilgisteurare. Dr. Ritter von Lobositz in der Wiener Med. Wochenschrift, 1879, No. 4. Dragendorff “Manuel de Toxicologie.”

Reveil (*Formulaires des Medicaments nouveaux*, p. 470,) has seen curara employed successfully in a case of hydrophobia, in a child, at the Children's Hospital. Five milligrams of curara were injected at three different times, and the more alarming symptoms disappeared within two hours. The solution employed was:—

R.—Curaræ.....	0.05
Aq. puræ.....	25.0

Dr. Offenbergs says:—

“Der *Preuss. Med. Kalender*, 1878 u. 1879, p. 12, gibt auffälliger Weise für das curare geringere Dosen an, als für das Curarinum sulphuricum, nämlich für ersteres, 0.0012–0.002; für letzteres aber, 0.002–0.01. Man sieht daraus, welche Verwirrung in der Curare Angelegenheit noch herrscht.”

From Dr. Dolan's work we find that Prof. Sewell was the first who suggested the idea of curara, and Waterton, who went in quest of the poison, and acquired it in its pure state, at his own expense, and at the cost of his own health, has generously given him the credit of the suggestion. Sewell, on the authority of Waterton, is said to have declared before Sir Joseph Banks and a large company of scientific gentlemen, that, were he unfortunate enough to be bitten by a mad dog, and become infected with rabies, he would not hesitate one moment in having the woorali poison applied, as he felt confident that the application of it would prove successful. The history of this poison is most interesting. Taylor, in his classic work on poisons, quotes Waterton's account, and thus offers us some guarantee of the veracity of the much abused naturalist. We shall give an abridged account from the original work, from the folio

edition, 1825. In the month of April, 1812, Waterton left the town of Stabrock to travel through the wilds of Demerara and Essequibo, with the chief object of collecting a quantity of the strongest woorali poison ; and after penetrating into the country where the poisonous ingredients grew, where the composition was prepared and used, success attended his adventure. After 121 days he acquired all the information about it, and a supply which he brought back with him to England. The poisonous extract is made from the woorali vine, a bitter root, two kinds of bulbous plants, two species of ants, the strongest Indian pepper, and the powdered fangs of the Labaria and Counacouchi snakes. The Maracoushi Indian makes the best preparation. Having found the necessary ingredients, the Indian scrapes the woorali vine and the bitter root into thin shavings, and puts them into a kind of colander, made of leaves ; this he holds over an earthen pot, and pours water on the shavings ; the liquor which comes through has the appearance of coffee. When a sufficient quantity has been obtained, the shavings are thrown aside. He then bruises the bulbous stalks, and squeezes a proportionate quantity of their juice through his hands into the pot. Lastly, the snake's fangs, ants, and pepper are bruised and thrown into it. It is then placed on a slow fire, and, as it boils, more of the juice of the woorali is added, according as it may be found necessary, and the scum is taken off with a leaf. It remains on the fire till reduced to a thick syrup of a deep brown color. As soon as it has arrived at this state, a few arrows are poisoned with it, to try its strength. If it answer the expectations,

it is poured into a calabash, or a little pot of Indian manufacture, which is carefully covered with a couple of leaves, and over them a piece of deer skin, tied round with cord.

They keep it in the dryest part of the hut, and from time to time suspend it over the fire to counteract the effect of dampness. The operation of making it was gloomy and mysterious. No women or young girls were present, lest the Zabahout, or Evil Spirit, should do them harm. The shed under which it had been boiled was pronounced polluted, the pot must never have held anything before, while the maker had to fast as long as the operation lasted. We may now consider that all the ingredients mentioned are not necessary to produce the effects of the poison, but that they were added through the superstitious feelings and customs of the natives. According to Waterton and Taylor—

1. The extract is so miscible with water, that the slightest moisture dissolves it; hence it speedily diffuses itself when introduced into a wound.

2. The symptoms are stupor and paralysis; it does not produce any apparent effect until after the lapse of one or two minutes, and the wounded animal apparently dies without a struggle and without pain.

3. The flesh of the animal thus killed may be used as food.

4. The dose must be proportioned to the size of the animal.

5. Like the serpent poison, it is active when introduced into a wound, but almost inert when taken into the stomach. (Bernard.)

6. Animals poisoned by it have been restored by keeping up artificial respiration, as instanced by the experiments at Nottingham, England, in which Dr. Sibson took part.

7. The extract retains its power for an indefinite period, but unless kept dry it is liable to become weakened in its properties.

8. The effect is to destroy the motor power of the nervous system, and the observations of Kölliker and Pelikau show that its action is the opposite to that of strychnia. M. Bernard remarks that there is no direct relation between the chemical character of a substance and its physiological effects. The same or similar characters may exist in two bodies—curarina and strychnia—of which the physiological effects are not only different, but antagonistic.

9. We may mention, as a memorandum to be borne in mind, that, according to Taylor, curara, which has but a slight action when swallowed, would, however, give the chemical reactions of strychnia in the stomach, and thus induce some chemists to swear that, beyond all doubt, strychnia was present, and that the person must have died from it.

In taking leave of Waterton and his woorali, we must direct attention to the following remarks made by him in 1844:—

“ It is an acknowledged fact that the art of medicine has hitherto been unable to arrest the fatal progress of confirmed hydrophobia. This being the case, it is both wise and expedient to give the sufferer a chance of saving his life by the supposed, although, as yet, untried, efficacy of the woorali poison, which, worst come to the worst, would, by its sedative and narcotic qualities, render

death calm and composed, and free from pain ; a circumstance not to be expected under the ordinary treatment, or no treatment at all, of this ungovernable and fatal malady."

The woorali of the present day is differently prepared from that of the Indian preparation. It is called curara, and has many synonyms : ourari, urari, woorari, woorara, wourali, wouraly. Besides the writers we have mentioned — Waterton, Taylor, Bernard — who have described this poison, the most recent authority (at the time of Dr. Dolan's writing) is Schomburgh, who states that it consists alone of vegetable matter, chiefly of an extract of the bark of *strychnos toxifera* (N. O. Loganiaceæ), a tree found in Guiana. Waterton, as mentioned, describes his woorali poison as soft, while other writers speak of the necessity of keeping it in a perfectly dry state. Taylor (*On Poisons*, 1875) says that "curara is a brownish-black, brittle substance, having the appearance of Spanish liquorice. It dissolves slowly in cold water, but rapidly when heated, producing a turbid brown liquid ; this becomes clear upon filtration." * * * Although curarine, the alkaloid of curara, possesses some of the characteristics of strychnine, sufficient proof has been obtained (*Tella, Pharm. Journ.*, vol. XI, p. 213) that it is totally distinct from the latter, and that their action is antagonistic.

Preyer was the first to isolate curarine in the crystalline form ; according to him it has the formula $C_{10}H_{15}N$. It is very hygroscopic ; has a very bitter taste ; crystallizes in colorless four-sided prisms ; dissolves freely in water and alcohol, less easily in chloroform and amyl alcohol ; and is insoluble in anhydrous ether, benzol,

turpentine, and carbon disulphide. It acquires a splendid and permanent blue color in contact with sulphuric acid, purple red with nitric acid, and violet with potassium dichromate and sulphuric acid (like that of strychnia, but more permanent). Its hydrochloride, nitrate, sulphate, and acetate are crystallizable. Dragendorff also finds that curarine is quite distinct from strychnine, and that a very active curara occurs in commerce, in which neither strychnine nor brucine can be detected.

The syringe should be reserved for the use of curara alone, and the surgeon should use every precaution, so as not to injure himself.

Dr. Offenbergh writes: "Das Eulenburgh'sche Recept, 0.1 curarinum sulfuricum in 5.0 aqua kostet demnach über 30.0 Mark. In den vorhin erwähnten in Münster beobachteten Falle von Tetanus wurde im Ganzen 0.435 Curarinum sulfuricum verbraucht, was 130 Mark ausmachte. Die Erfahrung lehrt jedoch, dass solche Stoffe nur so lange theuer sind, als sie nur selten verlangt werden."

In the *Dublin Medical Press*, p. 575, 1862, is the following case of Bossi:—

Result and Time of Attack.—108 days after. Fatal in sixty-seven hours.

Treatment.—Curara was used. In twenty-seven hours, forty-one injections were given with the syringe of Pravaz. Each containing $1\frac{1}{4}$ gram of curara distilled in distilled water; $18\frac{3}{4}$ centigrams were therefore injected.

Remarks.—A commission was appointed at the Milan Hospital, for the purpose of testing the remedy—wou-

rali or curara; it has been tried in hydrophobia, but without good results, though we have three cases reported which recovered after its use. The following are the terms in which the commission embodied the result of their report in two cases:—

1. In the case of Bossi there was no cauterization. Broggi was cauterized simply with nitrate of silver, seven hours after the bite.

2. The prodromic symptoms were manifested in Broggi fifty-eight days after the introduction of the virus.

3. The duration of the disease from its development to death, in Broggi, was 103 days.

4. At no moment did the curara appear to act on the rabid symptoms.

5. In both cases there was profuse perspiration, and in Bossi a marked but passing action on the circulation, evidenced by a quickening of the pulse. The autopsy showed in both cases red coloration and fluidity of the blood.

This poison is so deadly that the greatest care must be exercised by the operator, not only as regards his patient, but in order that he himself may not be inoculated, for the smallest quantity coming in contact with a scratch may give rise to serious results. As a remedy for hydrophobia, the injections should be small and frequently repeated, and so timed that the physiological effects may be obtained in the interval.

Dr. Watson, of Jersey City, in the *American Journal of Medical Sciences*, July, 1876, reports an instance which was regarded by him and by Prof. Austin Flint,

Sr., as a pure case of hydrophobia. The dog was mad, and a servant girl, who was bitten at the same time and by the same animal, died from hydrophobia. Curara was employed. The doses were augmented from $\frac{1}{16}$ grain, $\frac{1}{8}$ grain, to $\frac{1}{6}$ grain, when, after the third injection, the unfavorable symptoms subsided. Dr. Dolan also reports the following: Female, æt. 24, bitten by a dog suspected rabid. The wound was burnt with caustic soda three days afterwards:—

RESULT AND TIME OF ATTACK. EIGHTY DAYS AFTERWARD AND
RECOVERY.

Treatment.—After having tried the injection of morphia and inhalations of chloroform without any benefit, it was decided to try full doses of curara, seeing the good results which had been obtained in tetanus. A subcutaneous injection of two centigrams of curara (about one-third of a grain) in water was administered. This was about three hours after the sudden onset of the disease. A quarter of an hour later, there having been no visible effect, the dose was repeated, after which the condition began slightly to improve—that is, there were longer intervals between the spasms, and the muscular movements became less, and finally ceased. This result induced a continued trial of the same treatment. The injections were continued, a somewhat larger dose (three centigrams) being used. They were timed in such a way that an interval sufficiently long between the doses was allowed for the physiological action of the drug, and for any manifestation of the curara intoxication to be obtained. Thus, at twelve o'clock the third injection was given, and the intervals of spasm became longer. In an hour another injection was ordered, and the intervals again became longer. At the same time the feeling of anxiety and oppression was less intense. A fifth injection was given at 2 A.M., and a sixth at 2.30. The intervals between the spasms now extended to ten minutes, and the pain in the chest and throat was almost gone. Indeed, there was a peculiar condition of hilarity and talkativeness, instead of the previous anxiety. Then the first appearances of loss of voluntary power just began to show them-

selves. After one more injection (the seventh), at 3.20, the spasms ceased entirely, and symptoms of a general paralysis of all voluntary movements became quickly apparent. The eyelids could only be moved with difficulty; there was difficulty also in speaking. Breathing continued normal; only twice was there any arrest of respiration, and this was overcome easily by making one or two rhythmical movements with the abdominal parietes; the breathing then continued regular. After these toxic effects had lasted with this intensity about two hours, movements again became freer. Some hours after the last injection of curara, it was seen that the dread of water no longer existed, as the girl could drink freely without any difficulty whatever. The sensitiveness to light also disappeared, and, indeed, all the symptoms of hydrophobia subsided. Thus within four hours and thirty-five minutes seven injections had been administered, representing altogether nineteen centigrams of curara. During the course of the next few days a mixture of symptoms, partly arising from the curara, and partly from the effects of the recent disease, developed. The latter consisted of slight muscular movements, and involuntary spasmodic respiratory troubles, which, for the most part, were produced by the irritation of drinking, or fright, though they occurred spontaneously every now and then. On the evening of the next day but one some of these symptoms assumed a serious aspect, and another injection of curara was at once ordered, after the administration of which they disappeared. These symptoms, though of much less intensity, continued to recur until the eighth day, after which they finally disappeared. The girl was discharged cured on December 3d of the same year, and went into service a few weeks later. She is now in perfect health.

Dr. Offenberg's Remarks.—The favorable action of curara in human hydrophobia may be explained as follows: The chief symptom certainly is the frequent spasms. These spasms, which become more violent after each attack, are the cause of the constantly increasing danger of the disease, and they are finally the cause of death, which results either from exhaustion or from acute asphyxia. Curara, unlike other narcotics, does not act directly on the nerve-centres, but seems to act rather on the peripheral nerves. Its chief action seems to consist in paralyzing the motor nerves, and especially (and soonest) those of the voluntary and

striped muscles; then, after large doses, those of the involuntary muscles. An animal to which large doses of curara have been administered cannot move about voluntarily, neither can reflex movements be produced. If the motor nerves or even the spinal cord are irritated by a very strong electric current during the action of curara, muscular contractions cannot be produced; the muscles seem to be cut off entirely from the nervous system. The administration of curara in hydrophobia is not new. Niemeyer seems to have been the first to have tried it. He injected in his case five milligrams, and then one centigram, at intervals of three or four hours. "This treatment seemed to be of temporary service, and to produce greater relief than very large injections of morphia." Niemeyer strongly urged a further trial of this drug in larger doses in other cases of hydrophobia. No other successful results seem to have been obtained. Gualla has used curara in four cases of hydrophobia, and without success, but it is doubtful whether his doses were large enough. Theoretical arguments, no less than the above case, seem to indicate that the paralyzing effect of curara is necessary to secure success. This case also proves that life may be sustained in spite of general muscular paralysis, the chief effort being, of course, to keep up respiration by artificial means. There is less danger of cardiac paralysis. It is a misfortune that a definite dose of curara cannot be indicated, the doses variously allowed by authors ranging from one milligram to fifteen centigrams. The difference depends, probably, on the quality of the drug. Another explanation, however, may be given. The action of curara depends chiefly on the excitability of the nervous system. The greater, then, the excitation and the excitability, and the greater the physical exaltation, the more violent and intense will be the spasms, and the greater, therefore, must be the amount of the curara to hold these spasms in check. Thus, not only in different cases, but also at different periods in the course of the same case, entirely different doses of the same preparation will be indicated. A dose of curara, such as in a healthy individual with a normal nervous system would produce decided effects on the motor powers, would produce scarcely any effect whatever on one who is the subject of hydrophobia. The knowledge of this circumstance is of great importance, and we may commence at once with larger doses than we should probably

otherwise employ; yet the difficulties of administering the drug are only partially overcome, especially as we have to administer it until we get paralyzing effects. Obviously the safest way, then, to administer curara is to give small doses, and to repeat them at short intervals, until the effects we desire are brought about; and as a subcutaneously administered dose commences to act in a few minutes, and further, as (according to Demme) the action of a dose of curara only lasts from four to five hours, so then we may most surely and safely obtain the effects of curara by oft repeated small injections. Thus, if an injection be practiced every half hour—a period of time which largely suffices in order to get the action, and the whole action, of an injected dose of curara—we shall be able within four or five hours, to make eight or ten injections. In using curara in this manner, we not only secure its physiological action, but also guard ourselves against any sudden and too energetic manifestation of its toxic qualities. The action of small doses is proportionate, both in intensity and duration, and so soon as any dangerous symptoms show themselves, we should withhold its further administration, and take precautions suitable to the occasion. * * * * The various precautions to take, then, and the dosage, will depend on the individual case, and must be left to the discretion of the surgeon in charge.

Oxygen.—Drs. Schmidt and Zebeden, of Russia, report a case in which the first symptoms of hydrophobia appeared seventeen days after the injury. The patient was made to inhale three cubic feet of oxygen, and two hours afterward he was in a state of perfect calm. Two days afterward the symptoms of hydrophobia reappeared, and another inhalation of oxygen was administered with the same success. This time the inhalation was continued for forty-five minutes. A slight dyspnoea, which persisted after the disappearance of the graver symptoms, was treated for three weeks by the monobromide of camphor.

In the New York *Herald* of April 30th, 1879, this letter appeared :—

To the Editor of the Herald :—

The two recent deaths from hydrophobia in Brooklyn again illustrating the inability of medical science to grapple with this fearful disease, it may be acceptable to the public to know that a well-authenticated cure of hydrophobia is stated to be occupying some attention in European medical circles. The discovery is due to the experiment of two Russian physicians, Drs. Schmidt and Zebeden. A little girl was bitten in the hand by a mad dog. The wound, after being cauterized, healed in a few days, but a fortnight after the symptoms of hydrophobia set in. The physicians thereupon made the little patient inhale three cubic feet of oxygen. By this means, in the course of an hour and a half, all the symptoms disappeared, and the child remained calm. On the next day but one the malady returned in all its distressing characteristics, difficulty of breathing and swallowing, and tonic convulsions. A fresh inhalation of oxygen was tried, and at the end of forty-five minutes the attack subsided and never returned. The above information comes by way of Paris, the particulars of the case being given almost in the words above recorded. Here is a remedy, perfectly simple, and obtainable with ease in New York, and I think it would be prudent if the physicians, in the next case, at least, put it to the test.

J. M.

This is the sum of the literature of oxygen in the treatment of hydrophobia. It is the most recent advance in therapeutics, and if it be true, as I hold it to be, that the primary disturbance is due to a ferment which inhibits the proper function of the red corpuscles, then the employment of oxygen would be most rational. So far from being convinced that the nervous manifestations of hydrophobia are primary, and that to their correction our remedial agencies should be directed, I would rather seek in the blood the cause engendering

such symptoms of nervous derangement, and treat them as intercurrent and secondary disorders.

Turkish Baths.—Sir Thomas Watson, in his *Practice of Physic*, sums up his treatment of hydrophobia as follows: "And with respect to the established disease, I think that if I were the unhappy subject of it, I should wish to be put into a hot air bath and thoroughly sweated, and to take opiates; not so much in the hope of recovering, as with a view to the euthanasia." Fleming writes: "Hot water or vapor baths should more particularly be resorted to during the incubatory period, as they are likely to increase the excitement, dyspnœa, and cerebro-spinal congestion, when the malady has actually declared itself or made some progress." The Turkish bath is not a preservative, per se, but is a most useful supplemental agent and adjunct to the mental treatment. By acting upon the pores and rendering more active the function of the skin, it serves to eliminate deleterious matters from the blood, and imparts general tonicity to the system. That it has been vaunted as a panacea for all diseases, and that its use has been much abused by charlatanism, should not militate against its proper employment by the intellectual practitioner. The abuse of any remedy should not contraindicate its legitimate use. Dr. Buisson asserts that he not only cured himself, but also eighty patients who had been bitten by rabid animals; but as hydrophobia may not necessarily develop after the bite of a rabid animal, and as other observers have failed to derive any benefit from the use of the Turkish bath, his evidence is not satisfactory. As an auxiliary, it is extremely

valuable. It soothes the nervous system, relieves the respiratory organs, cleanses the skin and imparts healthy action to the kidneys.

General Treatment.—Bouley says: “He is convinced that the practices or medications, whatever they may be, which address themselves to the morale of those who are the victims of rabic inoculations may prove very useful, and that he has caused persons who were laboring under the dread of hydrophobia to take some innocent beverage as an infallible specific.” He adds: “The memories I entertain of the immense contentment it has produced have always confirmed me in the belief that it is not good to destroy such illusions and belief, but, on the contrary, to create them.”

The influence of mind upon body is such a powerful and well-recognized factor at this time, in the treatment of any disease, that no one would be accused of charlatanism who ordered his patient a placebo, and by working upon the imagination established that faith in its efficacy which would induce mental quietude. The sight of a physician is oftentimes of benefit to the patient; hence the practitioner should use his moral power and influence, and so gain the confidence of the sufferer as to establish a feeling of security. If sleep be disturbed, we may legitimately employ chloral hydrate or subcutaneous injections of morphia. And lastly, we should bear in mind an important matter mentioned by Fleming:—

“If a person has been bitten by a dog, or if animals have been wounded by it, and the creature at the time does not exhibit any distinct signs of rabies, it is well, to tranquillize the minds of those

chiefly concerned, and who are apprehensive of danger, to secure it properly for a number of days, say a fortnight or three weeks, before allowing it to go at large again. If it was really rabid when it inflicted the injury, it will soon exhibit unmistakable signs of disease and die; or it may then be killed, and every precaution taken accordingly. If the above mentioned period passes without any manifestation of rabies, then the possibility of future disaster ensuing from the wound is happily disposed of, and great anxiety abolished. But if the dog is destroyed without any evidence that it was suffering from the disease, then months of the most painful suspense, and even anguish, may perhaps elapse before the result can be known. In these circumstances all that can be done is carefully to inquire into the aggressive animal's history, ascertain all the symptoms exhibited by it, and its behavior immediately before and after inflicting the wound."

M. Desjardine, recognizing the value of this measure, says that as soon as a person has been bitten by a suspected animal, we should hasten to secure it, so that it can do no more damage, and watch it closely, instead of killing it at once, as is the custom. Give it several drops of syrup of buckthorn, and afterwards a dose of phosphorus, 15 centigrams, reduced to powder, and mixed in sufficient quantity of water. If the animal lives, its healthy condition should be made known to the person, for the mind exercises so great an influence that it seems at times and in certain conditions, according to the idiosyncrasy of the individual, to constitute the sole and unique cause of this terrible affection. But if, on the contrary, the dog dies, its death must be carefully concealed, or another must be substituted, in order to make the person believe that the animal was healthy, and that the treatment to which he was submitted was merely adopted to dispel the fear and alarm he experienced on receipt of the injury.

CHAPTER VIII.

TREATMENT CONTINUED.

Preventive.—The following résumé of preventive measures is taken from Dr. Dolan:—

A. The owners of dogs and other animals should be made to understand the responsibility that rests upon them with regard to the health of their animals, particularly when contagious diseases appear among them.

B. The number of useless dogs should be diminished as much as possible, and a tax should be levied on all dogs.

C. Every dog should wear a collar, with owner's name and address engraved thereon, as well as a particular mark impressed by the licensing or police authorities; for the proper registration and identification of the animal.

D. All stray dogs without the collar or the owner's name and address, should be captured, and, if not claimed within a limited period, sold or destroyed; and dogs straying with the proper collar on may, when circumstances render it necessary, be seized and confined or returned to the owner, who pays expenses and is fined, if need be. Bitches in rut should not be allowed to go at large at any time.

E. Unless under special circumstances, as when rabies is prevalent, or when certain animals are vicious, the muzzle should not be worn.

F. The owners of dogs should be held responsible for the damage done by them.

G. Diseased dogs, or those which show the slightest symptoms of disease, altered habits, etc., should be carefully watched, and precautions adopted. If the symptoms of rabies appear, the circumstances should be reported to the police by the owner or attendant on the dog, or other persons who know of its condition. Neglect of this should be estimated as a criminal offence. The police should know the early symptoms of the disease,

H. If other animals which have been in contact with or bitten by a rabid dog, become unwell afterwards, the symptoms ought to be noticed, and should they lead to a suspicion of rabies, the creatures must be isolated and their condition reported to the police.

I. Suspected animals should not be killed at once, if they have bitten any person, but only destroyed when the disease is unmistakably present.

J. A mad or suspected dog escaping from its owner, or appearing in a district, should be the signal of alertness, and those who know of the circumstances ought to warn the police at once. Children should be guarded and animals confined or kept from strange dogs. All wandering dogs should be confined or killed.

K. Rabid dogs should be killed, or, if suspected, they may be kept until their condition is ascertained.

L. The police authorities should endeavor to obtain every information about any rabid or suspected dog, and to discover the name and address of its owner; learning also what damage it may have done. Regulations and restrictions should be extended over a wide space of country, and neighboring districts should be warned. All information necessary to put the inhabitants on the alert ought also to be given.

M. When the disease appears in a virulent or epizootic form, all measures ought to be vigorously enforced. Owners of dogs should give due notice of all changes occurring among their animals. Muzzling may be necessary, but the muzzle for each dog should be properly and securely constructed, and sufficient in size without being too large. It must have appliances for attaching it firmly to the head.

N. The destruction and confinement of dogs must be assiduously carried out, and heavy fines or imprisonment should be imposed upon those who attempt to evade or neglect the regulations.

O. Dogs should be slaughtered with as little cruelty as possible. They ought to be buried deeply in the ground.

P. Disinfection should be carried out as with other contagious diseases.

Q. The police regulations and restrictions should be continued for some months beyond the appearance of the last case of rabies. This period should be dependent on the limit of the incubatory stage of the disease in the dog.

R. With regard to other animals, when wounded by a suspected or rabid dog, the circumstance should be reported, and steps taken to insure safety. Horses, oxen and other working animals may be employed in the immediate vicinity of their homes, but must not be sold, bartered or removed within a certain period. The immediate slaughter of wounded or suspected animals is not necessary, but as soon as rabies manifests itself notice should be given to the local authorities, and the necessary steps taken to prevent damage. The bodies should be buried intact, though, under special circumstances, skinning them may be allowed, in order to tan or dress these parts.

S. Disinfection to be resorted to, as in the case of rabid dogs.

T. The flesh is not dangerous as food until the symptoms of the disease have appeared. If used before this period, certain precautions should be adopted.

V. The milk may also be utilized during the same period.

X. Competent veterinarians must coöperate in the execution of these measures.

From the *Gesetz betreffend die Abwehr und Unterdrückung, vom 25 June, 1875, etc., etc., Berlin, 1877*, kindly furnished me by Mr. Kreisman, Consul-General at Berlin, I translate as follows:—

HYDROPHOBIA OF DOMESTIC ANIMALS—PRESERVATIVE.

106. *Dogs.*—Dogs which have rabies, or show signs of it, must be killed immediately, or safely secured until the arrival of the police or owner. If people have already been bitten by such an animal, or if in any way such people have come in contact with a rabid dog, the suspicion of infection being well founded, the dog should not be killed until the arrival of the police, but should be locked up, if this can be done without danger.

107. The transportation of a dog suspected to be rabid must be done in a close conveyance, or, after muzzling him, by leading him with a chain; if he cannot be muzzled, he must be led by two chains, between two men.

108. The police court of the precinct must see to it that the dogs which have been locked up are examined immediately by an offi-

cial, or, if it should take long to send for him, any other approved veterinary surgeon may examine the dog. If the opinion of the surgeon should leave it in doubt whether the dog has been subjected to the infection from another dog, known to be "mad," he should be locked up for six days, and if at the expiration of this time he should be still alive, he is to be set free.

109. If a dog who is suspected to be rabid should be killed, or if he should die during his isolation, he should be dissected by the veterinary, upon order of the police court, to ascertain if man or beast could have contracted the disease from him while he was running about.

110. If the existence of rabies has been established by the modes prescribed in § 11 and § 12 of the law, the police court must publicly announce the outbreak of the disease in the newspapers which are selected for the purposes of the court.

111. According to § 49 of the law, rabid dogs must be killed immediately. The police court must also order to be killed all those dogs which are suspected to have been bitten by a rabid dog, or in whom the suspicion of infection may be looked upon as proven.

112. If a dog be rabid, or, if suspected of being so, has been running about without being muzzled, the police court must order all dogs in the place to be chained [§ 50 of the law]. Every town must be regarded as exposed to danger, in which rabid dogs or suspicious dogs are seen. All places within four kilometers of the place must also be looked upon as dangerous. If the suspicion of rabies be groundless, the order for chaining the dogs must be revoked; but if the existence of the disease is proven, they must be chained up for at least three months. The police can order all dogs running about the streets, supposed to be rabid, to be killed at once, regardless of the court's order. In towns in which dogs are muzzled this order need not be enforced. This order is not intended to apply to dogs which are used for pulling carts, if they are harnessed securely to the cart and are muzzled. Shepherds' dogs are also exempt.

As long as the disease is not of great extent, hunting dogs, employed for hunting purposes, if they are securely muzzled when not upon the hunting grounds, or if they are led by a cord.

2. *Cats*.—313. The rules in § 100–111 will apply to cats which show signs of madness, with the necessary modifications.

314. Other domestic animals which are bitten by a rabid animal, or by one who has been in the neighborhood of a rabid animal, in whom the suspicion of infection is proven, must be put under police observation, during the dangerous period, provided that the owner does not wish him to be killed.

115. For horses, the period of danger is supposed to be three months; for cattle, four months; for sheep, goats or swine, two months.

116. As long as the animals are proved by the inspection of the veterinary to be free from the disease, they may be employed for labor. If they show changes which prove them to be rabid, the owner is compelled to notify the police court immediately. The court will summon the veterinary, and if the animals are shown to be rabid, they must be locked up in the stable.

117. If rabies be proved, the animal must be killed immediately.

118. No curative means shall be employed upon any animal supposed to be rabid, before the arrival of the police.

119. It is forbidden to slaughter or to skin any rabid animal, or sell any part or production of the same.

120. The bodies of any rabid animals who may have been killed are to be burned by chemicals, or to be buried, after cutting off the skin. The use of any part is forbidden. The authorized veterinary surgeon is the only one permitted to dissect the body. The police court must designate a place for the burial of such bodies.

121. Wooden utensils, kennels and stewpans used for dogs, must be burned. Stable utensils used for other domestic animals must be cleansed with soap-lye or with boiling water; iron articles must be made over. Stables must be cleaned, and the walls and floors disinfected with the chlorate of lime.

122. In regard to rabid animals which are delivered to Royal medical colleges, or kept in the animal hospitals, or any high college, the 22d paragraph of the law must be observed.

The following regulation exists in London. It forms part of "An act for regulating the Traffic in the Me-

metropolis, and for making provision for the greater security of persons passing through the streets, and for other purposes." [20th August, 1867, 30 and 31 Vict., chap. 134.]

"Police may take possession of any dog found in any street within the metropolis, and not under the control of any person, and may detain such dog until the owner has claimed the same and paid all expenses incurred by reason of such detention. The Commissioner of Police, if he see fit, may issue a notice requiring any dog, while in the streets, and not led by some person, to be muzzled in such a manner as will admit of the animal breathing and drinking without obstruction; and the police may take possession of any dog found loose in the streets and without such muzzle, during the currency of the order, and may detain such dog until the owner has claimed it, has provided a proper muzzle and has paid all expenses connected with such detention. Where any dog, taken possession of by the police, wears a collar with the address of any person inscribed thereon, a letter, stating the fact of such dog having been taken possession of, shall be sent by post to the address inscribed on the collar. The Commissioner of Police may cause any dog which has remained in the possession of the police for three clear days without the owner claiming the same, and paying all expenses incurred by its detention, to be sold or destroyed. Any moneys arising from the sale of any dogs in pursuance of this section shall be applied in the manner in which penalties under this act are applicable. When, upon complaint that any dog has bitten or attempted to bite any person within the metropolis, it appears to magistrates having cognizance of such complaint that any such dog ought to be destroyed, the magistrate may direct the dog to be destroyed, and any police constable may destroy the same accordingly; and all dogs detained by the police under this section shall be properly fed and maintained."

The New English Dog Act, published on the 24th of July, 1871, and entitled "An act to provide further protection against dogs," is applicable to the whole of Great Britain. It is as follows:—

“Whereas, it is expedient that further protection should be provided against dogs:

“Be it enacted by the Queen’s most excellent Majesty, by and with the advice and consent of the Lords, spiritual and temporal, and Commons, in this present Parliament assembled, and by the authority of the same, as follows:—

“1. From and after the passing of this Act any police officer or constable may take possession of any dog that he has reason to suppose to be savage or dangerous, straying on any highway and not under the control of any person, and may detain such dog until the owner has claimed the same and paid all expenses incurred by reason of such detention.

“Where the owner of any dog taken possession of by any constable is known, a letter, stating the fact of such dog having been taken possession of, shall be sent by post or otherwise, to the owner at his usual or last known place of abode. When any dog taken in pursuance of this Act has been detained for three clear days, where the owner is not known, as aforesaid, or for five clear days where he is so known, without the owner claiming the same and paying all expenses incurred by its detention, the chief officer of police of the district in which such dog was found may cause such dog to be sold or destroyed.

“Any moneys arising from the sale of any dogs, in pursuance of this section, shall be paid to the account of the local rate, and be applied to the purposes to which that rate is applicable.

“All dogs detained under this section shall be properly fed and maintained at the expense of the local rate.

“2. Any Court of Summary Jurisdiction may take cognizance of a complaint that a dog is dangerous and not kept under proper control, and if it appears to the Court having cognizance of such complaint that such dog is dangerous, the Court may make an order, in a summary way, directing the dog to be kept by the owner under proper control or destroyed; and any person failing to comply with such order shall be liable to a penalty not exceeding twenty shillings for every day during which he fails to comply with such order.

“3. The local authorities may, if a mad dog, or a dog suspected of being mad, is found within their jurisdiction, make, and when made, vary or revoke, an order placing such restrictions as they may think expedient on all dogs not under the control of any per-

son during such period as may be prescribed in such order, throughout the whole of their jurisdiction, or such part thereof as may be prescribed in such order.

“Any person who acts in contravention of any order made in pursuance of this section shall be liable to a penalty not exceeding twenty shillings.

“Due notice of such order shall be published, at the expense of the local rate.

“The provisions of this Act contained as to the detention and sale or destruction of dogs found straying on the highway shall apply to dogs found at large in contravention of any order made in pursuance of this section.

“4. In England and Ireland any penalty under this Act may be recovered in manner provided by the Summary Jurisdiction Act, and in Scotland all such penalties shall be prosecuted and recovered before a Court of Summary Jurisdiction, under the provisions of the Summary Jurisdiction Act, 1864.”

Max Du Camp (*En Hollande*, Paris, 1859), states :
“At Harlingen, in Friesland, I saw a dog pass which had a wooden cross hanging at its neck ; then a second dog and a third ; and finally I observed that every dog in the town was decorated with a similar ornament. Making inquiry respecting this matter, I was informed that all dogs not wearing the cross were, in the canton of Harlingen, immediately apprehended and led by the ears to the pound ; for the crosses are issued by the municipality, and their possession proves that the tax imposed upon such animals has been paid.”

The Austrian Penal Code (387) says :—

“Whoever knows of a dog or any other animal showing the distinctive symptoms, or symptoms which warrant suspicion, of rabies, and who neglects to report the same to the police, is guilty of infraction of the law and liable to imprisonment. In case of the appearance of the disease, and the biting of men or of animals, the culprit shall be punished with from three days’ to three months’

imprisonment (*carcere duro*). If a serious wound or the death of a human being has been the consequence of this negligence, the infraction shall come under the application of 335, which says: 'He who shall be guilty of this negligence shall be punished with from one to six months' imprisonment, if its consequence has been a serious wound; if the death of a man has been the consequence, the penalty is from six months' to a year's close imprisonment. Otherwise, the proprietor is always responsible for the damage caused by mad animals.' "

The same Code (371) says: "Every owner of an animal, no matter to what species it may belong, which he knows to be vicious, ought, in or out of doors, to watch and take care of it, so that it may not wound any one. Any damage caused by the neglect of this precaution is punishable by a fine of from five to twenty-five florins, if there has been no wound inflicted; but when this is the case, the penalty may be increased to from ten to fifty florins."

The French Civil Code ordains that "the proprietor of an animal, or he who employs it, while it is in his employment, is responsible for the damage that it causes, either while in his charge or when it is straying or escaped."

CHAPTER IX.

HOW TO RECOGNIZE A "MAD" DOG. EMERGENCIES,
AND HOW TO TREAT THEM.

*Résumé of the Symptoms in the Dog.**—As it is most important that the symptoms of rabies in the dog should be remembered, the following *résumé* of the most notable are given, for the guidance of those who keep dogs, or who may have more or less to do with them. Medical men might usefully bear the details in memory, and educate the public in respect to them:—

1. The disease is not characterized by fits of fury at its commencement, but is, on the contrary, to all appearances, a benignant malady, though even then the saliva or foam is virulent and poisonous. The dog is at this period very dangerous, by its licking rather than biting, for as yet it has no tendency to use its teeth.

2. At the commencement of the disease the animal's temper becomes changed. It is dull, gloomy and silent; seeks solitude and withdraws into the most obscure corners. But it cannot rest long in one place; it is fidgety and agitated; goes here and there; lies down and gets up; prowls about, smells, and scratches with its forepaws. Its movements, attitudes and gestures, at times, would indicate that it is haunted by and sees phantoms; it snaps at the air, and barks as if attacked by real enemies.

3. Its appearance is altered; it has a gloomy and somewhat ferocious aspect.

* Dr. Dolan.

4. In this condition, however, it is not aggressive, so far as mankind is concerned, but is as docile and obedient to its master as before. It may even appear to be more affectionate towards those it knows, and this it manifests by a greater desire to lick their hands and faces.

5. This affection, which is always so marked and so enduring in the dog, dominates it so strongly in rabies that it will not injure those it loves, even in a paroxysm of madness; and even when its ferocious instincts are beginning to be manifested and to gain the supremacy over it, it will yet yield obedience to those to whom it has been accustomed.

6. The mad dog has not a dread of water, but, on the contrary, will greedily swallow it. As long as it can drink, it will satisfy its ever-ardent thirst; even when the spasms in the throat prevent it swallowing, it will nevertheless plunge its face deeply into the water and appear to gulp at it. The dog is not, therefore, hydrophobic, and hydrophobia is not a sign of madness in this animal.

7. It does not generally refuse food in the early part of the disease, but sometimes eats with more voracity than formerly.

8. When the desire to bite, which is one of the essential characters of rabies at a certain stage, begins to manifest itself, the animal at first attacks inert bodies—gnawing wood, leather, its chain, carpets, straw, hair, coal, earth, the excrement of other animals, or even its own; and accumulates in its stomach the remains of all the substances it has been tearing with its teeth.

9. An abundance of saliva is not a constant symptom of rabies in the dog. Sometimes its mouth is humid, and sometimes it is dry. Before a fit of madness, the secretion of saliva is normal; during this period it may be increased, but towards the end of the malady it is usually decreased.

10. The animal often expresses a sensation of inconvenience or pain during the spasm in its throat, by using its paws on the side of its mouth, like a dog which has a bone lodged there.

11. In dumb madness the lower jaw is paralyzed and drops, leaving the mouth open and dry, and its lining membrane exhibiting a reddish-brown hue; the tongue is frequently brown or blue colored; one or both eyes squint, and the creature is ordinarily helpless and not aggressive.

12. In some instances the rabid dog vomits a chocolate or blood-colored fluid.

13. The voice is always changed in tone, and the animal howls or barks in quite a different fashion to what it did in health. The sound is husky and jerking. In "dumb" madness, however, this very important symptom is absent.

14. The sensibility of the rabid dog is greatly blunted. When it is struck, burned or wounded, it emits no cry of pain or sign as when it suffers or is afraid in health. It will even sometimes wound itself severely with its teeth, and without attempting to hurt any person it knows.

15. The mad dog is always very much enraged at the sight of an animal of its own species. Even when the

malady might be considered as yet in a latent condition, as soon as it sees another dog it shows this strange antipathy, and appears desirous of attacking it. This is a most important indication.

16. It often flies from home when the ferocious instincts commence to gain an ascendancy, and after one, two or three days' wandering, during which it has tried to gratify its mad fancies on all the living creatures it encountered, it often returns to its master to die. At other times, it escapes in the night, and after doing as much damage as its violence prompts it to do, it will return again towards morning. The distances a mad dog will travel, even in a short period, are sometimes very great.

17. The furious period of rabies is characterized by an expression of ferocity in the animal's physiognomy, and by the desire to bite whenever an opportunity offers. It always prefers to attack another dog, though other animals are also victims.

18. The paroxysms of fury are succeeded by periods of comparative calm, during which the appearance of the creature is liable to mislead the uninitiated as to the nature of the malady.

19. The mad dog usually attacks other creatures rather than man, when at liberty. When exhausted by the paroxysms and contentions it has experienced, it runs in an unsteady manner, its tail pendant and head inclined towards the ground, its eyes wandering and frequently squinting, and its mouth open, with the bluish-colored tongue, soiled with dust, protruding. In this condition it has no longer the violent, aggressive

tendencies of the previous stage, though it will yet bite every one, man or beast, that it can reach with its teeth, especially if irritated.

20. The mad dog that is not killed perishes from paralysis and asphyxia. To the last moment, the terrible desire to bite is predominant, even when the poor creature is so prostrated as to appear to be transformed into an inert mass.

Upon the first appearance of any suspicious symptoms, the animal should be isolated and very carefully watched. It is an error, as common as it is cruel, that a dog who has bitten any animal should be killed at once. Should this accident occur, the animal should be kept by himself, and each day the progress of the case should be noted. If the disease should not be hydrophobia, we have the comforting assurance of immunity from painful sequelæ to those who may have been bitten. On the other hand, if, as is too commonly the case, the dog should be immediately killed, a constant dread would surround the patient—a fear that at some remote period hydrophobia might be developed. In this way most disastrous nervous conditions may be engendered. *Never kill a dog until the symptoms of hydrophobia are beyond the question of a doubt.* The influence of sex upon the spontaneous appearance of hydrophobia is not as great as is generally supposed, and Dr. Dolan seems to doubt if it have any weight whatever. On the other hand, M. Renault, Inspector of the French Veterinary schools, has asserted that the disease is only spontaneous in the male. The influence of the generative act in producing the disease is equally uncertain.

Upon this point Dr. Dolan writes: "At present we can only deem it probable that there may be some foundation for the supposition that intense sexual excitement may produce rabies, especially when the desire is not capable of being gratified. The relation of the periods of 'rutting' must also be taken into consideration. The dog-bitch is usually in rut in February and August, and if procreation does not take place, it is sometimes renewed three months later, in May and November. Of course, in domesticity there are exceptions to this rule. The cat usually ruts in spring and autumn, but is also affected by domestic habits. The female fox commences to be in rut about January and February, and the she-wolf, when aged, towards the end of December and in January. Younger animals are so in February and the beginning of March. If the production of rabies was at all connected with this condition of the generative system, then we might expect the malady would be only prevalent at the period when rutting is general, whereas we find it is observed at all seasons; indeed, if the causes enumerated were at all influential in producing the disease, we should not only have it much more frequently than it now is, but it would be common in countries where it is very rare and never witnessed."

Rabies attacks all breeds of dogs indiscriminately. Eckel gives the following percentage:—

Mongrels of all kinds.....	53 $\frac{1}{2}$	per cent.
Small English breed.....	12 $\frac{1}{2}$	" "
Fox hounds.....	6 $\frac{1}{2}$	" "
Poodles.. ..	5	" "

Pomeranians	2 $\frac{2}{7}$	per cent.
Danish dogs and pointers.....	2 $\frac{6}{7}$	“ “
Pugs and turnspits	2 $\frac{1}{7}$	“ “
Mastiffs.....	1 $\frac{3}{7}$	“ “
Hounds }	6 $\frac{5}{7}$	“ “
Sheep dogs }		

Saint Cyr furnishes the following :—

Hounds.....	3	}	35 per cent.
Spaniels.....	16		
Pomeranians.....	12		
Mastiffs.....	6	}	46.20 per cent.
Bull and house dogs....	4		
Newfoundland dogs....	3		
Mongrels.....	4	}	18.80 “ “
Montons	2		
Terriers, greyhounds....	2		
King Charles, pug	2		

In every instance it must be strenuously denied that a bite from a healthy dog, whether he be angry or not, whether in rutting season or not, can produce the disease known as rabies. “The influence of certain seasons in inducing the production of rabies has long been a popular notion, which, it would appear, the stern testimony of facts has not been quite potent enough to dispel. During the hot weather—the ‘dog days,’ as a certain portion of the summer has been designated—it has been universally believed that the canine race is particularly liable to be attacked by madness, possibly from the apparent distress dogs manifest when exposed to heat, as evidenced by restlessness, panting, thirst, etc. This popular notion that rabies is more common in summer than winter is of the highest antiquity, and seems to

have been connected in some way with the celebration of the festum Cynophontia of the Argives. But is it the case that rabies is more frequent in hot than in cold or temperate weather, or, in other words, that heat induces the disease? The evidence furnished by statistics compiled in France and Germany incontestably proves that it is not during hot weather that rabies is most prevalent, but during the cold and mild seasons. * * The best veterinarians agree that meteorological conditions and the different seasons have little effect in exciting or determining the evolution of spontaneous rabies, and that it is a disease which may appear in any season, or in any kind of weather." (Dolan, op. cit.)

Emergencies.—A person at a distance from medical assistance has been bitten by a dog supposed to be rabid: what must be done? Place at once a tight bandage above the bite, between it and the heart, so as to arrest the circulation in the part, then allow a stream of water to pour freely over the wound. After fifteen minutes, dissect out the part bitten, or cauterize with an iron at white heat—nitrate of silver is objectionable, on account of subsequent bleeding. Fuming nitric acid is the best agent to use next to the actual cautery. Give whisky or ammonia freely. Calm the nervous system, with the assurance that the danger of hydrophobia is nil, if the local trouble be taken in time. If it be possible, place the dog under the strictest surveillance. If rabies does not develop, we can assure the patient absolutely that there is no possible ground for alarm. These preliminaries having been carried out faithfully, consult the nearest physician without delay. If it be impossible to

obtain the hot iron, flash some gunpowder in the wound. Should this be impossible, open the wound freely with a pocket knife, so as to encourage copious bleeding, then pack the opening with moist clay. Be cool. Act quickly. The probabilities are largely in favor of any one bitten if timely precautions are made use of.

CHAPTER X.

CURIOSITIES OF LITERATURE.

“Although the various pilgrimages have lost their reputation since the Revolution, yet, to-day the relics of Saint Hubert are much esteemed, and a large number of people who have been bitten by rabid dogs, or reported so to be, expect to find in these a preventive of the disease. Arriving at Saint Hubert, the patient presents himself at the church, the priest makes a slight incision upon the forehead, and instead of placing in it a thread of the sainted stole, as the common people suppose, he introduces an irritating herb. He binds the head with a bandage; he orders a certain course of living for six weeks; on the ninth day the bandage is removed, and solemnly burned in the choir of the church; his convalescence is celebrated with pomp, and upon the fortieth day the cure is entirely accomplished. The rules prescribed by the priest are as follows: Not to wash or change the linen, to eat every day out of the same dish, to drink no white wine, avoid looking at himself, and in walking look always in front, etc. (*Rev. Encyc. Janvier*, 1820.) In Italy, it is sufficient for the cure of hydrophobia, that one should touch the keys of the church in which Bellin, a priest of Padua, a town fifteen miles from Rovigo, is buried. The keys of the churches of Saint Guilterie, of Saint Roch, of Saint Pierre de Bruges, are said to possess similar virtue.” (Translated from the *Dictionnaire Encyclopédique des Sciences Médi-*

cales.) Pliny (*Hist. Nat.*, lib. xxix) advises the use of the liver of a mad dog. The menstrual fluid of a woman, and the urine of a virtuous young man, have also been recommended. The Prussian electuary, bought by Frederick the Great from a peasant of Silesia, consisted of cantharides taken internally, and applied externally to the wound. The celebrated Chinese Tonquin powder was composed of 16 grains of musk, 20 grains of native cinnabar and 20 grains of cinnabar of antimony, to be taken in a glass of brandy. The magic omelet was made as follows: Bake the shells of the male oyster, reduced to powder, mix with eggs and beat up with oil, etc. The Swartzenberg and Paulmier powders, have also had their advocates. Dr. Holland's list of remedies which have been used in the treatment of this disease is inexhaustible; among the number we find: Pounded ants, badger soup, the excrement of a calf, the brains and comb of a cock, cuckoo soup, carral, the blood and purified excrement, liver, urine, the worm under the tongue of a mad dog, the liver of a male goat, horse dung, the tail of a strew mouse, flesh of the unicorn, mad wort, and other palatable compounds of like nature. Dioscorides, Celsus, Ætius, Galen, Latta and Bunkenhout have lauded sucking the wound. This custom dates back to the time of Cleopatra, and history recounts the exploit of Eleanor, who sucked the wound of King Edward I. "Still grosser superstitions exist in reference to smothering," writes Dr. Dolan; "an historical mode of death familiar to the readers of history in connection with King Edward V and his brother; while Shakspeare has immortalized it by making Othello,

through jealousy, smother Desdemona. On some such plea as the words uttered by Othello, suffocation was resorted to—

“‘ I that am cruel, am yet merciful :

I would not have thee linger in thy pain.’”

Act v, Scene ii.

There are not only traditions of the suffocation of the unfortunate victims between feather beds, but we have evidence of the existence of the custom. We have selected a few cases from *Notes and Queries*.

In the *Dublin Chronicle*, October 28th, 1798, the following circumstances are recorded: A fine boy, aged fourteen, was bitten by a lady's lap dog, at Black Rock, near Dublin. In about two hours the youth was seized with convulsive fits, and shortly after with hydrophobia; and notwithstanding every assistance, his friends were obliged to smother him between two feather beds. (*Notes and Queries*, 2d ser., vol. ix, p. 454.) We need only say this was not a case of rabies, as it never develops within such a period, and as for the authenticity of the statement we do not vouch.

Mr. G. R. Jesse, Hendbury, Cheshire, in *Notes and Queries*, vol. x, p. 382, also informs us that sufferers were bled to death or smothered. “A man in the Revolution murdered his brother under this pretext.” Daniels' *Rural Sports* mentions, I think, an instance of smothering rabid patients between feather beds, and that the parties were tried and acquitted. See, likewise, Scot's *British Field Sports*, 1818, p. 195, for a case of bleeding to death; in the same disease, people appear to have been poisoned or drowned. There are many local

traditions, also, in regard to this smothering. There was a current belief through the north of Scotland, sixty years ago, that a Countess of Fife, about the end of last century, or the beginning of the present, while fondling her lap dog, had been bitten in the lip, and was seized with hydrophobia, and when all hope of cure was at an end, was smothered between two feather beds.

In the *Irish Times* of May 18th, 1861, we find the following:—

Case of Hydrophobia. Melancholy Occurrence.—A fatal case of hydrophobia is reported from Newport, County Tipperary, the victim being a fine young woman. It appears that while being engaged in some outdoor employment, a neighbor's dog bit her in the hand. Hydrophobia in its most fearful aspect set in, and she became so hopelessly mad that it was found necessary to smother her between two feather beds. (*Notes and Queries*, 2d series, vol. ix, p. 478.)

In the *Guardian* of April 3d, 1867, it was also said to be announced that a little daughter of Mr. A. Woodruff, of the town of Greenfield, Michigan, having been seized with hydrophobia, a consultation was held by the physicians, who decided that, as the patient could not possibly survive, every consideration of humanity demanded that her sufferings be ended by some means, in accordance with which the child was smothered to death. (*Notes and Queries*, 3d series, vol. ii, p. 376.)

From *Notes and Queries*, 1st series, vol x, p. 469, we learn, that at an inquest held in October, 1866, at Bradwell, Bucks, on the body of a child who had died from hydrophobia, evidence was given of a practice almost

incredible in civilized England. A witness stated that she had fished out of the river the dead body of the dog which had inflicted the bite, taken out its liver, fried a bit of it on the fire, and given it to the child to eat.

In reference to the power of curing, Mr. Francis Robert Davis writes to *Notes and Queries* (1st series, vol. ix), that a man named Monsel, living at Kilrush, in the County Clare, possessed a cure for hydrophobia which was never known to fail. He required that the patient should be brought to him nine days from the time of his being bitten, when he made him look into a pail of water, or a looking glass. If he bore that trial without showing any uneasiness, he declared there was no doubt of his being able to effect a cure. He then retired to another room, leaving the patient alone for a short time, and when he returned he brought two bits of cheese which he said contained the remedy, and caused the person to swallow them. He then desired him to return home, and for nine days frequently drink a few sips of water, and also take opportunities of looking at water or a looking glass, so as to get the nerves under control. He acted evidently on the imagination of the patient. The following is from the *People*, Wexford, Ireland:—

“*Certain Cure for the Bite of a Mad Dog.*—We have been favored with the following recipe, which, we learn, has been used by a family in this country for generations with unfailing success in preventing the terrible effects that follow the bite of a mad dog:—

“Take three wineglassfuls of the juice of the narrow rib-leaf (*plantago minor*), also called narrow-leafed plan-

tain and narrow rib-wort; one wineglassful of common salt, and one-quarter of a pound of butter. Mix and simmer gently for twenty minutes. Take a wineglassful in the morning—no food to be taken for at least an hour after; take a second wineglassful the same evening—no food to be used for at least one hour before or after; take a third wineglassful on the second morning—no food to be taken for at least one hour before or after taking it. Many persons in the country will recollect this cure being applied for in the vicinity of New Ross, and of its being used with success. It is preventive, when used by either man or beast, of the effects of the bite of a mad dog.”

In West Prussia an incantation practiced very extensively consisted of the words “Pax, Max, Imax,” written with a piece of wood three times on a slice of buttered toast, to be eaten by the patient.

The most curious of these charms is one said to be practiced in Russia. It consists of the following form of words and signs also scratched on buttered toast, to be eaten by the patient:—

“ + Iryon + Syryon + Kiryon +
 Karyon + Koforyn + Styleda +
 Staletura + Kakara + Idota +
 Strydota + Syon + Bryan +
 Et + Deus + Meus. + ”

Holland says: “This is not Russian, but the last three words are Latin.”

Desault mentions that the Church of St. Villa, in Pouille, was very celebrated for the prevention of rabies.

The person who applied for relief making the tour of the church every night for three weeks, singing the following hymn :—

“ Alma vitæ Pellicane,
Oram què tenes Apulam,
Litusque Pollignanicum,
Irasque canum mitigas :
Tu Sancte rabiem asperam
Rectusque canis luridos
Tu sævam prohibe luem.
I procul hinc rabies
Procul hinc furor omnis abesto ?”

As an illustration of what curious superstitions still lurk among rural populations, the *Students' Journal*, 1877, mentions that at Rivesaltes, in the south of France, some terrible cases of hydrophobia have recently occurred. The local authorities, therefore, determined to adopt preventive measures, and accordingly sent for some *salondadons*, or, as we should say, *seventh sons*, who in those districts are believed to have the miraculous power of curing the bites inflicted by mad dogs, and of blessing small pieces of bread called *passagnats*, which are supposed to ward off hydrophobia. The *salondadon* performs his cures by means of a crucifix, uttering the while sacramental words from a liturgy peculiar to himself. The seventh sons are supposed to have a variety of other powers not granted to ordinary mortals, such as treading under foot or applying to the tongue a bar of red-hot iron without receiving any injury.

CHAPTER XI.

THE MOST RECENT VIEWS OF THE PATHOLOGY AND
TREATMENT OF HYDROPHOBIA.

Several cases reported in the winter of 1880-81 illustrate the most recent views on the pathology and treatment of hydrophobia:—

In the *Journal of Anatomy and Physiology* there is a paper by Dr. George Middleton, Assistant to the Professor of the Practice of Medicine in the University of Glasgow, chiefly founded on observations made on two cases of hydrophobia which were under the care of Professor Charteris. Briefly, the lesions found might be said to be an almost universally increased vascularity, often venous, but also referable to the smaller arteries, of the different organs and tissues of the body, coupled with frequent hemorrhages, often punctiform in character, together with a great tendency to the accumulation of leucocytes in the vessels, perivascular spaces, and surrounding structures, more especially of the nervous system. These perivascular changes were chiefly noted in the lower part of the brain and upper part of the spinal cord, where the leucocytes sometimes formed small, rounded masses, which might be called miliary abscesses. "In both cases examined numerous vessels were seen, clothed with round cells—a condition which in the second case became clearly less intense as the sections were made lower in the cord. The gray matter was chiefly affected, due, as has been pointed out by

others, to the greater frequency of vessels there." No special aggregation of leucocytes was observed in the spaces round the larger ganglion cells, as had been noted by Coats; nor were they grouped in any unusual or striking fashion round the nuclei of the hypoglossal, glosso-pharyngeal and vagus, as noted by Gowers.

From this it will be seen that, apart from the general characteristics of the morbid appearances already indicated, especially the tendency to the accumulation of leucocytes around the smaller blood-vessels and in the neighboring tissues, there is no definiteness or uniformity in the pathological conditions found after death in different cases of hydrophobia. This, again, is in itself sufficient to show that in these appearances we have no clue to the causation of the highly characteristic and most distressing symptoms of the malady.

But Dr. Middleton has gone further than this. He selected twenty-four cases, not taken consecutively, but selected in the post-mortem room, as more or less likely to have been connected with nervous symptoms. The central nervous system was first examined, roughly and microscopically, and subsequently the clinical records were consulted as to the actual symptoms during life. The results thus obtained were striking. In a case of purpura hæmorrhagica "the microscope revealed an exceedingly well-marked lesion of the vessels, quite similar to that seen in hydrophobia." Of three cases of diabetes, one showed lesions similar to but "not so pronounced as in hydrophobia." The lesions described by Dickinson as existing in diabetes were not seen. Four cases of head injury "all showed a lesion similar to that

found in hydrophobia, but in two of them it was very slight. In all there was great cerebral excitement, and the case in which this lasted for the shortest time showed least evidence of the perivascular lesion." In one case of delirium tremens coupled with injury and erysipelas there were marked perivascular changes. In another, of delirium tremens pure and simple, there were hardly any; but the examination was incomplete. In a case of opium poisoning there were none. In a case of hydrocephalus with marked cerebral symptoms there were none. In two cases of tubercular meningitis they were marked. In one case of tetanus they were marked; in another doubtful, but "the nerve-tissue, especially in the pons, presented numerous rounded gaps, with regular outlines." Of two cases of Bright's disease with uræmic symptoms the same lesion as in hydrophobia was seen around the vessels of the medulla, the pons, the optic thalami and corpora striata, especially in the medulla. In another case, where the uræmic symptoms only lasted twenty-four hours, the appearances were similar, but less intense. Briefly, therefore, the author concludes "that the perivascular lesion is by no means characteristic of hydrophobia; that it is commonly found in cases characterized by cerebral excitement, and that the intensity of the lesion varies directly with the intensity and duration of the cerebral symptoms."

Probably it is not safe to go further than the propositions put by Dr. Coats, viz.: "that in hydrophobia there is an irritant in the blood which attacks a considerable number of organs, the signs of irritation being most manifest in the neighborhood of the finer blood-vessels;

that it is probable that this irritant attacks some vessels more than others, especially those of the central nervous system; that in the nervous system the medulla oblongata and spinal cord are most the subject of the lesion, which scarcely shows itself in the higher centres." This by no means excludes the possibility of local changes similar to those found in hydrophobia being associated with cerebral excitement. But cerebral excitement is one thing, and motor acts which we are accustomed to refer specially to the medulla and cord are another.

From the same source is the following instance of the use of *pilocarpin* as a remedy. The case was laid before the Glasgow Medico-Chirurgical Society, by Dr. Charteris. He said:—

"Pilocarpin was the remedy employed in this case, and it was at one time hoped that the trial would have justified its selection; for the patient was a muscular athlete, tall, strong and wiry, whose constitution was unimpaired by previous illness, and who had, as he said, 'neither tasted drink nor smoked tobacco in his life.' The drug lowered the temperature, promoted copious salivation and perspiration, and, strange to say, the inability to swallow was entirely removed, and the gloominess that hung over the patient at first was succeeded by wild bursts of delirious joy, with fanciful pictures of happiness and peace. The struggle, fierce and terribly violent, which lasted four days, seemed to exhaust the man, and without convulsions and without terror he sank and died. The clinical record of this case, after it had been decided to try pilocarpin, is as follows: At 9.45 A. M., when first seen, his pulse was 150 and his temperature 102.6°. One-third of a grain of pilocarpin was injected, and in about three minutes afterwards he began to hawk and spit profusely, and this was followed by a copious perspiration. At 11.15 the injection was repeated, causing the same symptoms; and when seen at 12 he was lying comparatively quiet and 'sweating awfully,' as he said. His temperature had fallen to 101°, fully a degree and a half, his pulse being 140. At 2 P. M. the

reduction of temperature was more noted, as it was 100° , and his pulse was 130. At 4 P.M. he complained of severe pain in the back of his head, for which a poultice was applied. He now asked for a drink of milk. The nurse steadied his hand and assisted him to bring the cup to his head; when it was there he threw the milk into his mouth as a man might do a pill, and swallowed it with a great gulp. After he had done this, he rose to his full height in bed and said, 'I have swallowed at last. I am a cured man. I'll go home to-morrow; but don't mind me, don't mind me, when I get out.' Everything was done to foster the idea that he was getting better, and he promised money and the eternal gratitude of himself and family, adding, 'The Vale of Leven will wonder when they see me back a cured man.' At 6 P.M. pilocarpin was repeated, but the result was not the same as before, for little perspiration was induced, but instead copious micturition. His temperature had again risen to 102° , and his pulse was 160. At 9 P.M. his condition with regard to temperature and pulse was unaltered, and he talked incessantly. Bromide of potassium was given in large doses, but no sleep was obtained. At 9 A.M., when again seen, he said he had not slept, for men had come in and sat on him, bruising him much all down the back. His temperature was 102° . Pilocarpin was again injected, but little perspiration was induced. At 12, three hours afterwards, pain was experienced over the kidney, and a trace of albumen detected in the urine. He saw his wife, at his own request, and to show her he was better he took some milk with an effort, but no particular spasm. He had taken in all, since his amendment, two pots of Brand's essence of beef. At 4 P.M. the nurse stated he had dozed about ten minutes at a time, but he had had no sound sleep. He appeared much excited about being beaten. Later on he slept about an hour, after having an egg beat up with brandy, and on awakening he took a slice of bread soaked in water and some essence of beef. During the remainder of the day and the following morning he was simply exhausted, through constant talking and want of sleep, but he could swallow easily. At 9 A.M. he wished to go out, and actually reached the door, but was persuaded to return. His exhaustion was very intense and the albumen in the urine very abundant. At noon of the same day he died."

In the *British Medical Journal* for 1878, Dr. J. G. S. Coghill has an article, "Jaborandi proposed as a remedy in Hydrophobia, from observations of two cases of the disease observed in man," and in the *American Journal of Medical Sciences*, 1878, Dr. W. J. Forbes extols the use of *nitrite of amyl* in mitigating the paroxysms of pain. The patients upon whom pilocarpin was tried died from extreme exhaustion—a condition which, it is alleged, may be attributable to the severity of the disease rather than to the effects of the drug. The hydrophobic convulsions had so lowered the vitality before the treatment with pilocarpin was commenced that the patients were unable to rally, although the painful manifestations of the disease were magically dissipated. For nitrite of amyl nothing is claimed more than that it exerts a calming influence. Pilocarpin is a paralyzant of the vaso-motor nervous system. It reduces temperature by the profuse transpiration which it causes and by depressing the vascular tonus. It reduces the arterial tension and increases the heart-action. It enormously increases the amount of urea passed out in the sweat. If a case of hydrophobia should be seen, upon the first appreciable manifestation of the disease the exhibition of jaborandi, or of its active principle, might possibly be attended with good results, although I am unable to explain, upon any logical deductions of physiological therapy, why we should expect such favorable action in any other way than by supposing that the diminution of the vascular tonus, with the excessive transpiration and reduced arterial tension, may ultimately prevent the terrible nervous irritation. This state of nervous ex-

citement never obtains primarily as a distinct neurosis, but is preceded by a symptomatology of blood poisoning, and it is to this mal-nutrition that the nervous lesion is due. Hence, should pilocarpin aid in withdrawing from the system the noxious principles that interfere with normal blood nourishment, it would serve an admirable purpose. The exciting cause of the nervous disorder would be taken out of the system before it could excite to action that secondary manifestation of which the altered blood supply was the first. We must consider, however, the alarming exhaustion which very generally follows upon the use of any of the preparations of jaborandi. Can we afford, at any stage of the disease, to lower the strength of the patient? Will not this induced condition of physical exhaustion give rise to the very train of nervous symptoms which we are trying to avert?

Recent pathology seems to sustain the opinion which I advanced in preceding chapters of this work. I have no reason to depart from such impression, and I still believe that if we are to treat hydrophobia successfully we must do so by making use of those remedies which will act directly upon the blood. The primary excitant is a blood irritant, which addresses itself chiefly to the finer vessels supplying the central nervous system. The condition of "disorganization," founded upon post-mortem examination of the cord, is an effect of the altered blood supply, and cannot now be regarded in any sense as a primary lesion.

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